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U.S. Army Corps of Engineers,
Seattle District, Regulatory Branch

Programmatic Biological Evaluation for Habitat Restoration/Rehabilitation Activities in the State of Washington for Species Listed or Proposed by National Marine Fisheries Service and U.S. Fish and Wildlife Service under the Endangered Species Act

(Phase II – Restoration Programmatic)

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I. Executive Summary

The U.S. Army Corps of Engineers, Seattle District, Regulatory Branch (Corps) regulates discharge of dredged or fill materials in waters of the U.S. (including wetlands) and construction of structures or work in navigable waters of the United States. The regulatory boundary for Seattle District is the state of Washington.

In May 1999, fish species listed or proposed for listing as threatened or endangered in the state of Washington under the Endangered Species Act of 1973 (ESA), as amended increased to a total of 18 species. The number of animal and plant species listed or proposed for listing in the state of Washington now totaled 56 species. With the additional listings, 90-95 percent of the applications reviewed by the Corps in Seattle District required some level of ESA consultation. This number was a significant increased from previous years. With the additional workload placed on the Corps, U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)[1], improving consultation procedures became essential. In an effort to provide more consistent and efficient review of permit actions and thereby providing more effective protection of listed or proposed species, the Corps' Regulatory Branch is initiating a programmatic consultation with the Services for restoration and rehabilitation activities proposed by public and private applicants seeking Department of the Army permits.

If restoration and rehabilitation activities fall within the parameters described within this document, the Corps proposes an abbreviated ESA consultation procedure with the Services. In addition to the abbreviated consultation procedure, regular monitoring and

[1] USFWS and NMFS are hereby jointly referred to as "the Services".

reporting on individual projects as well as regular monitoring and reporting on the programmatic consultation overall are included.

II. Intent of Use

This programmatic consultation is intended for those activities requiring a Department of the Army permit for the purpose of restoration and rehabilitation of habitat for native species in the state of Washington. For the purpose of this programmatic consultation, restoration is defined as "an activity whose primary purpose is to return a natural aquatic, riparian or wetland habitat to its properly functioning condition." Rehabilitation is defined as "an activity whose primary purpose is to create or enhance functions or processes limited or lacking within the natural aquatic, riparian or wetland habitat."

The Corps is consulting with the Services on a state-wide level for all restoration/rehabilitation activities described herein for impacts that may occur to listed or proposed species within the state of Washington. The goal of this programmatic consultation is to further the protection and recovery of threatened and endangered species through consistent guidelines for restoration activities and an abbreviated consultation procedure.

The Corps seeks to obtain approval of an abbreviated Section 7 consultation process through a programmatic biological opinion from both Services. The Corps understands that this programmatic biological opinion may provide incidental take for activities described or may only provide a determination of "no jeopardy" for activities described, with incidental take statements provided on an individual basis through an abbreviated Section 7 consultation. If an activity does not meet the description or parameters approved within the final programmatic consultation, the activity will go through individual consultation as outlined in Section 7 of the ESA.

A. Corps Regulatory Program

Statutory Authorities

The Corps regulates activities in waters of the U.S. through, Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act[2] of 1972, and Section 103 of Marine Protection, Research and Sanctuaries Act of 1972. The activities discussed within are regulated under Section 10 of Rivers and Harbors Act of 1899 and/or Section 404 of the Clean Water Act.

Under Section 10 of the Rivers and Harbors Act of 1899, a Department of the Army permit is required for any structures or work in navigable waters of the United States. Conclusive determinations of navigability can be made only by the United States Congress and/or by the federal courts.[3] For Washington state, a list of navigable waters of the United States and their extents are available on the Corps website – **www.nws.usace.army.mil/reg/reg.htm**. Under Section 10, the Corps regulates all activities waterward of the ordinary high water (OHW) in non-tidal waters and waterward of mean high water (MHW) in tidal waters.

Section 404 of the Clean Water Act requires a Department of the Army permit for the discharge of dredged or fill materials into all waters of the U.S., including special aquatic sites such as wetlands, mudflats, and vegetated shallows. Under Section 404, the Corps regulates all fill or discharge activities waterward of the OHW in non-tidal wetlands and waterward of mean higher high water (MHHW) to the limit of the United States territorial seas[4] in tidal waters. If wetlands or special aquatic sites occur adjacent to the open water, the Corps jurisdiction extends to the landward limits of the wetlands or special aquatic site. For wetlands that are tributaries to waters of the U.S., the Corps

[2] Also known as the Federal Water Pollution Control Act of 1948, as amended.
[3] 33 CFR 329.14(a)
[4] United States territorial seas extend waterward 3 nautical miles.

jurisdiction follows the boundaries of the wetlands.[5] There are six different discharges that do not require a Section 404 permit. These activities are defined in 33 CFR 323.4. These exemptions only apply to Section 404 jurisdiction. There are no exemptions for Section 10 of the Rivers and Harbors Act or Section 103 of the Marine Protection, Research and Sanctuaries Act.

Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 requires a Department of the Army permit for the transportation of dredged material to be disposed of in the ocean waters. "Ocean waters" are defined as those waters of the open seas lying seaward of the base line from which the territorial sea is measured.[6]

ESA Consultation Requirements

In accordance with Section 7(a)(2) of the ESA, all federal agencies are required, in consultation with USFWS and/or NMFS, to insure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.[7] For the Corps' Regulatory Branch, the "action" is the Department of the Army permit authorization.

In addition, Section 7(a)(1) of the ESA directs all federal agencies to utilize their authorities in furtherance of the purposes of ESA by carrying out programs for the conservation and recovery of species listed pursuant to ESA.[8] The Corps, in an effort to further the conservation and recovery of listed species, proposes the programmatic consultation for restoration/rehabilitation activities. Through an abbreviated consultation procedure for restoration/rehabilitation activities, those activities will be more readily authorized and implemented.

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[5] Wetland boundaries are delineated as per the "Corps of Engineers Wetland Delineation Manual" January 1987.
[6] 33 CFR 324.2(a)
[7] 50 CFR 402.
[8] Section 7(a)(1) and see also 50 CFR 402.01(a).

B. Summary of Types of Activities Addressed

In compliance with conservation measures associated with each activity and/or species, this programmatic consultation addresses the activities described in Table II-1: Programmatic Restoration/Rehabilitation Activities.

Table II-1: Programmatic Restoration/Rehabilitation Activities

For all activities covered by the programmatic consultation, conservation measures shall be implemented as outlined in the Project descriptions, Conservation Measures, and Effects Analysis Section.

Removal of Fish Passage Barriers at:

a. Stream Crossings by Roads, Levees, Dikes, or Similar Features

Covered:

- Replacement of culverts or bridges.
- Modification of impassible culverts.
- Construction of fish passage weirs, directly related to replacement, modification, or removal of stream crossings.
- Construction of bed control structures, keyed into the streambank, directly related to replacement, modification, or removal of stream crossings.
- Streambed grading directly related to replacement, modification, or removal of stream crossings.
- Placement of streambed substrate and woody debris directly related to removal, replacement, or modification of stream crossings.
- Installation of bank protection on the roadway fill prism directly related to replacement, modification, or removal of stream crossings.

Not Covered:

- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques (this restriction does not apply to protection of the fill prism of a road or work required to key bed control structures into the streambank; see above).
- Culvert or bridge replacement or modification activities that do not provide or facilitate fish passage.
- Construction of new stream crossings.
- Replacement of culverts or bridges that are part of larger development projects (i.e. the removal of the fish passage barrier does not have independent utility from other related work).
- Other activities at existing or new stream crossings that are not associated with restoration or rehabilitation of fish passage.

Table II-1

b. Tide Gates

Covered:

- Replacement of tide gates or the connected culverts.
- Modification of tide gates or the connected culverts.
- Removal of tide gates or the connected culverts.

Not Covered:

- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques.
- Tide gate replacement or modification activities that do not provide or facilitate fish passage.
- Installation of new tide gates.
- Other activities at existing tide gates that are not associated with restoration or rehabilitation of fish passage.

Table II-1

c. Certain Types of Debris Jams

Covered:

- Complete removal of garbage, **landscape waste, construction waste and debris, or industrial debris from stream channels**;
- Use of mechanized equipment provided the equipment works from the streambank and no new access roads are required;
- Streambed grading directly related to debris jam removal within 50 feet of the debris jam removal site; and
- Streambank grading and riparian planting directly related to debris jam removal within 50 feet of the debris jam removal site.

Not Covered:

- Removal of naturally occurring woody debris from any waterbody;
- Removal of beaver dams;
- Construction of new temporary or permanent roads to access the work area;
- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques;
- Partial removal of garbage, landscape waste, construction waste, or industrial debris from stream channels; and
- Other activities at debris jams that are not associated with restoration or rehabilitation of fish passage.

Table II-1

d. Certain Types of Sediment Bars or Terraces

Covered:

- Removal of up to 25 cubic yards of sediment from within 50 feet of the mouth of a stream;
- Temporary use of sandbags to restore fish passage or maintain fish life during periods of extremely low flows;
- Use of mechanized equipment provided the equipment works from the streambank and no new access roads are required;
- Streambed grading directly related to removal of sediment bars or terraces within 50 feet of the mouth of a stream; and
- Streambank grading and riparian planting directly related to removal of sediment bars or terraces within 50 feet of the work site.

Not Covered:

- Removal of more than 25 cubic yards of sediment from the mouth of a stream;
- Removal of any sediment further than 50 feet of the mouth of a stream;
- Removal of naturally occurring woody debris from any waterbody;
- Removal of beaver dams;
- Construction of new temporary or permanent roads to access the work area;
- Permanent use of sandbags to restore fish passage or maintain fish life.
- Use of sandbags for any other purpose other than restoration of fish passage or maintenance of fish life.
- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques;
- Other activities at sediment bars or terraces not associated with restoration or rehabilitation of fish passage.

III. Programmatic Consultation Implementation Procedures

For those activities addressed in this programmatic consultation, specific implementation procedures must be followed by the applicant and the Corps in order for the activity to be authorized under the programmatic consultation. These procedures include:

- Individual project review
- Individual project monitoring
- Compliance and enforcement procedures, and
- Programmatic Tracking and Reporting

A. Individual Project Review

In order to confirm that an activity falls within the parameters of the programmatic consultation on Restoration/Rehabilitation Activities, the applicant will complete and submit the "ESA Programmatic Consultation – Restoration/Rehabilitation Activities: Specific Project Information Form (SPIF)" (See Table III-1: Specific Project Information Form) in electronic form (including drawings and photographs). The applicant may choose to submit hard copies of the "SPIF" including drawings and photographs. However, consultation may be delayed due to regular postal delivery of the information to the Services.

Corps Review

In Seattle District, Regulatory Branch, there are two primary application reviewers – the project manager and the Environmental Analyst. The project manager, a generalist in background, oversees the application review process, coordinating with the applicant and state and federal agencies as necessary. The Environmental Analyst – a technical

Table III-1: Specific Project Information Form (SPIF)

Version: 19 May 2002

U.S. Army Corps of Engineers
Seattle District, Regulatory Branch
P.O. Box 3755
Seattle, Washington 98124

ESA Programmatic Consultation – Restoration/Rehabilitation Activities
Specific Project Information Form (SPIF)

FWS Programmatic Reference: *******

NMFS Programmatic Reference: WSB-01-197

1. Applicant: _____ **Corps Reference:** ****-*-*****

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____

2. Agent:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____

3. Project Location (include Vicinity map):

Section: _____ Township: _____ Range: _____

Latitude: _____ Longitude: _____

Waterbody: _____ County: _____

River Mile: _____ Tributary to: _____

4. Project Description (include drawings and photographs): Include all phased of the proposed project including construction, access (existing or new), staging areas, and maintenance and operation of the project. _____

_____

_____

a. Project Purpose: _____

_____

_____

b. Action Area Identified: ***(If unknown, contact the Corps Project Manager for assistance)***

_____

_____

_____

c. Programmatically approved activity(ies) proposed (Check all that apply):
(For descriptions of the activities, see the programmatic consultation)

Removal of Fish Passage Barriers

___ Removal or Replacement of Stream Crossings (describe type in project description)

___ Removal or Replacement of Tide Gates

___ Removal of Certain Types of Debris Jams

___ Removal or Modification of Certain Types of Sediment Bars & Flood Terraces

In-stream Restoration/Rehabilitation Activities:
(Activities to be submitted at a later date as additional chapters to the original document.)

Wetland Restoration/Rehabilitation Activities:
(Activities to be submitted at a later date as additional chapters to the original document.)

Marine/Estuarine Restoration/Rehabilitation Activities:
(Activities to be submitted at a later date as additional chapters to the original document.)

Other Activities: _____

d. Description of construction access and sequencing: _____

_____

_____

e. How long will it take to construct each project element (including number of construction seasons?

_____

_____

f. Proposed work windows (specify by month and date): _____

g. Habitat function proposed for restoration or rehabilitation (i.e. spawning areas, refuge areas):

_____

h. How was the targeted habitat function identified as a restoration/rehabilitation issue for the system (i.e. watershed analysis)? What is the pre-project level of the targeted habitat function within the action area?

_____

i. How will project restore or rehabilitate the targeted habitat function?

_____

5. **Environmental Baseline of Action Area:** Supplemental information on specific issues related to proposed activity not addressed under “Affected Environment” in the Programmatic Consultation. Information may include site-specific concerns or constraints and upstream and downstream conditions.

6. **Species Present:** What federally listed or proposed species and critical habitat occur in the action area? Include Species List from FWS and NMFS.

7. **Effects Analysis:** Discussion of potential effects not addressed within the Programmatic Consultation. Include potential cumulative effects of the proposed project.

8. **Avoidance and Minimization Measures:** Define what avoidance and minimization measures will be implemented to protect listed or proposed species and their critical habitat.

9. **Monitoring Plan:** Attach a monitoring plan following the outline in the Programmatic Consultation.

expert – reviews the permit decisions, jurisdictional determinations, and biological evaluations for scientific accuracy and consistency with Corps regulations. With workload separated geographically, the Environmental Analysts work with project managers in a team leader role.

The Corps project manager and Environmental Analyst will review the activity and supplemental information to determine the appropriate permitting procedure (Nationwide Permit, Letter of Permission or Individual Permit) and if the activity may be authorized under the programmatic consultation.

The project manager will review the *Requirements*[9] for each activity as outlined in the programmatic consultation. On the "ESA Programmatic Notification to the Services" (See Table III-2), the project manager will state – in consultation with the Environmental Analyst – which general programmatic consultation requirements, requirements for the activities proposed and/or requirements for the species present do not apply to this project. In addition, the Corps may propose additional requirements, alterations and/or modifications to existing requirements, or exclusion of requirements specific to the activity under review. On the "ESA Programmatic Notification to the Services", the project manager – in consultation with the Environmental Analyst – will state the proposed alteration/modification, exclusion, or additional requirements and the justification for the alteration/modification, exclusion or additional requirements.

The "ESA Programmatic Notification to the Services" and the "Specific Project Information Form (SPIF)" (Table III-1) – including drawings and photographs are hereby referred to as the "individual programmatic biological evaluation" (IPBE). The entire electronic versions or hardcopies of the IPBE will be sent to the Services.

The Corps will send the IPBE, either electronically or via post, to the USFWS Programmatic Coordinator for review. The Corps will only send the IPBE to the

[9] "Requirements" include the final conservation measures submitted by the Corps and the Reasonable and Prudent Measures with Terms and Conditions issued by USFWS and NMFS in biological opinions.

attention of the appropriate Team Leader at NMFS when either (1) additions, alterations/modifications and/or exclusions to the programmatic consultation requirements are proposed on a site-specific basis, or (2) the application of the programmatic consultation to the proposed activity is questionable and the Corps wishes NMFS to make a determination on the applicability.

While the IPBE is with the Services for review, the Corps project manager may proceed with the application review process as defined in Corps regulations but must not finalize the permit decision until individual programmatic consultation procedures have been completed.

USFWS Review

Within a 30 days of receipt of the IPBE (either electronic or via post), USFWS will provide the Corps with (1) a list of additional information needed to complete the individual programmatic consultation, (2) an individual programmatic biological opinion (IPBO), or (3) a date when initial review of the IPBE is anticipated.

The IPBO will include (1) statement of programmatic consultation applicability to the proposed activity, (2) incidental take approval, (3) approval/denial of the proposed additions, alterations/modifications or exclusions of conservation measures proposed by the Corps, and (4) additional site specific reasonable and prudent measures (RPMs) and/or terms and conditions, if necessary. The IPBO may be sent to the Corps electronically if sent via the Manager's e-mail account. Requests for additional information or notification of delay in review may be sent to the Corps electronically via the USFWS Programmatic Coordinator's or Staff Reviewer's e-mail account.

The Corps may not proceed with permit issuance until USFWS has issued an IPBO for the activity. For activities covered by this programmatic consultation, the Corps will include all conservation measures, reasonable and prudent measures (RPMs), and/or terms and conditions included in the IPBO as conditions of the permit.

Table III-2: ESA Programmatic Notification to the Services

Version: 19 May 2002

U.S. Army Corps of Engineers
Seattle District, Regulatory Branch

ESA PROGRAMMATIC NOTIFICATION - REQUEST FOR APPROVAL OF THE INDIVIDUAL PROGRAMMATIC BIOLOGICAL EVALUATION (IPBE)

TO: Programmatic Coordinator **USFWS** ___ **NMFS** ___

FROM: Corps of Engineers, Seattle District, Regulatory Branch, (206) 764-____

Project Manager: _____

Environmental Analyst: _____

Date: _____ Request for Response: _____
(30 calendar days)

Applicant: _____ Reference: _____

Waterway: _____

Proposed authorization (NWP#, RGP#, LOP, IP): _____

We request your approval on our determination that the above referenced activity is in compliance with the Programmatic Consultation for Restoration/Rehabilitation Activities, dated ******, and approved by your agency on *****. Enclosed is the Specific project information form including drawings and photographs.

Conservation Measures: Except for the following conservation measures (referenced by number), the Corps proposes to implement all the general conservation measures, conservation measures for the activity(ies) proposed, and conservation measures for the species present. The conservation measures to be excluded are:_____

_____

The Corps also proposes the additional conservation measure, exclusion, and/or alteration/modification to the following existing conservation measure:[10]

_____

_____

_____

The justification for this exclusion, addition, alteration and/or modification is as follows:

_____

_____

[10] Case by Case only – PM will include the full language of the addition, alteration and/or modification

If USFWS determines the proposed activity does not fit within the parameters of the programmatic consultation or the applicant declines to implement the conservation measures, RPMs, and/or terms and conditions included in the IPBO, the activity will go through individual consultation as outlined in Section 7 of the ESA.

NMFS Review

If the Corps notifies NMFS with an IPBE (either electronic or via post) as outlined under *Corps Review*, NMFS will respond to the Corps within 30 days with (1) a list of additional information needed to complete the programmatic consultation, (2) approval of the additions, alterations/modifications, and/or exclusions to the programmatic consultation requirements, (3) an individual programmatic biological opinion (IPBO), or (4) a date when initial review of the IPBE is anticipated.

If NMFS does not approve of the Corps' proposed additions, alterations/modifications and/or exclusions of requirements, the activity must either be adjusted to fit within the parameters of the existing programmatic consultation requirements or must proceed with individual consultation measures as outlined in Section 7 of the ESA. NMFS may send an electronic approval or statement declining approval of the Corps' proposed additions, alterations/modifications and/or exclusions of requirements – if the e-mail is from the NMFS Programmatic Coordinator or Team Leader. Requests for additional information or notification of delay in review may be sent to the Corps electronically via the NMFS Programmatic Coordinator's or Staff Reviewer's e-mail account.

NMFS will send an IPBO if the proposed activity will fit within the parameters of the programmatic consultation only with the addition of site specific reasonable and prudent measures (RPMs) and/or terms and conditions. The IPBO will include (1) statement of programmatic consultation applicability to the proposed activity, (2) approval/denial of the proposed additions, alterations/modifications or exclusions of conservation measures proposed by the Corps – if necessary, and (3) additional site specific

reasonable and prudent measures (RPMs) and/or terms and conditions, if necessary. The IPBO may be sent to the Corps electronically if sent via the Team Leader's e-mail account. Requests for additional information or notification of delay in review may be sent to the Corps electronically via the NMFS Programmatic Coordinator's or Staff Reviewer's e-mail account.

If the Corps initiates consultation with NMFS, the Corps may not proceed with permit issuance until NMFS has either submitted a statement that they agree with the application of the programmatic or NMFS has issued an IPBO for the activity. The Corps will include all conservation measures, RPMs, and/or terms and conditions included in the approval or IPBO as conditions of the permit.

If NMFS determines that the activity does not fit within the parameters of the programmatic consultation or the applicant declines to implement the conservation measures in the approval or the RPMS, and/or terms and conditions included in the IPBO, the activity will go through individual consultation as outlined in Section 7 of the ESA.

B. Individual Project Monitoring

All activities authorized under the programmatic consultation must submit a monitoring plan with the "Specific Project Information Form (SPIF)" (Table III-1) and must implement the monitoring plan in its entirety.

Monitoring requirements are as follows:

1. ***Monitoring Plans:*** The monitoring plan shall include:

- Project description, location, and drawings.
  - If revegetation is part of the proposal, a planting plan and schedule will be included.

- Goals and Objectives: State the goal and objectives of the restoration/rehabilitation project.
  - For example, a goal would be: restore chinook salmon access to the upper watershed of *Whoop-de-do* Creek.
  - There may be several objectives to achieve the one goal. For example: Objective 1: Replace the culvert at *Whosit Crossing* with a bridge, Objective 2: Restore stream channel under the new bridge to natural gradients, Objective 3: restore overhanging vegetation along the bank of *Whoop-de-do Creek.*

- Performance Standards: Performance standards are measurable levels to show the project is moving towards or has successfully met the goals and objectives.
  - State the frequency and length of the monitoring (i.e. monitor for 10 years at Years 1, 2, 4,7, and 10). Performance standards shall be set for every year proposed for monitoring. Depending on the function, the performance standard may change from year to year (i.e. increase in percentage vegetation coverage) or may stay the same (i.e. gradient of the stream bed).

- Monitoring protocols: Clearly outline how performance standards will be measured. Identify panorama photo points and transects, where appropriate.
  - Monitoring protocols will not result in additional take of the species.

- Contingency Measures: The Services' approval programmatic consultation (including the IPBO's) are based, in part, on successful completion of projects. Thus, the monitoring plan shall state what contingency measures are proposed if the activity does not successfully meet the goals and/or objectives. Contingency measures allow for alterations and/or modifications to the project design during the monitoring period to ensure the project is

reaching the stated goals and objectives. Implementation of contingency measures shall not occur without written approval from the Corps, in consultation with the Services.

2. ***As-built drawings and/or status reports*:** Typically, the Corps expects permittees to build projects according to approved drawings. However, it is not uncommon for restoration/rehabilitation work to involve some amount of alteration of design at the time of construction in order to improve the project's ability to meet stated goals and objectives. This may be due to such issues as micro-topography, hydrological considerations, or preservation of existing, but previously unidentified, habitat features (i.e. large trees). Thus, the permittee must notify the Corps in writing within one month of the completion of the project. The permittee must submit to the Corps within 13 months of permit issuance three (3) copies of the as-built drawings and photos. Photos will be taken as outlined in the approved monitoring plan. If the activity has not been completely constructed in this time frame, the permittee must submit a status report stating when the construction of the activity will be completed. If portions of the activity have been constructed, the permittee will submit as-built drawings of construction to date and a status report of when construction will be complete. Status reports will be required every year until construction is complete and as-built drawings have been submitted.

3. ***Site protection**:* For those projects where restoration or rehabilitation activities are extensive and the Corps determines these activities are in threat of significant disturbance or destruction in the future, site protection measures will be required. A statement shall be placed on the deed to notify all that any future in-water work or alteration to the site shall require Department of the Army authorization. As directed by the Corps, a description of the project areas will be recorded with the Registrar of Deeds or other appropriate official charged with the responsibility for

maintaining records to or interest in real property.[11] A statement to the following will be recorded on the deed: "The areas represented in Exhibit ** *(map of restoration/rehabilitation area)* are restoration/rehabilitation areas. Any alteration to wetlands or waters within these areas will require authorization from the Corps of Engineers, Seattle District, Regulatory Branch. Proposed alterations will be reviewed in light of the restored state of these areas." Proof of this documentation must be provided to the Corps of Engineers, Seattle District prior to final permit issuance.

4. ***Post-Construction Impact Assessment****:* A post-construction impact assessment will be submitted with the as-built drawings. The post-construction impact assessment will (1) identify what impacts actually occurred during construction, and (2) if any impacts were different than originally anticipated and why (i.e. alternative construction methods, weather conditions, etc.). The purpose of this assessment is to better identify the impacts associated with the activities addressed within the programmatic consultation and allow for informed modifications to the programmatic consultation.

5. ***Monitoring Reports****:* Monitoring reports will be submitted annually for a period that may extend up to or, in certain instances, beyond 10 years. The duration of the monitoring will be determined by the Corps on a case-by-case basis – in consultation with the Services. Three copies of the monitoring reports will be submitted to the Corps Regulatory Branch. The first year monitoring report will be due one year after the Corps' written acceptance of the as-built drawings. The monitoring reports will include measurement methods, photo points and transects, as outlined in the approved monitoring plan.

[11] The applicant may propose alternatives to the deed restriction to meet the site protection objective. The Corps will consider these alternatives on a case-by-case basis.

C. Compliance and Enforcement

When an activity is approved under the programmatic consultation and authorized by a Department of the Army permit, the Corps and the Services will ensure that all conditions of the completed programmatic consultation including the RPMs and/or terms and conditions of the IPBO, are implemented in their entirety.

The Corps has developed a database to track reporting requirements for Department of the Army permits. The Corps project manager inputs the report due dates into the database at the time of permit issuance (See Table III-3: Tracking Compliance Reports). If a permittee has missed a due date, the database notifies the project manager via e-mail that a report is past due. The project manager then notifies the permittee that the permit is out of compliance and the report must be submitted within 30 days or an enforcement action will be taken on the permit. The Corps has been successfully using this database tracking method for 4 years to ensure compliance with permit conditions.

When a status report, as-built drawing, post-construction impacts assessment or monitoring report is submitted to the Corps, the Corps project manager will review the reports for adequacy. The project manager will then forward the report for approval by the Corps compliance officer.[12] The compliance officer will determine if the conditions of the permit and monitoring plan have been met. Often, an activity is moving towards success but there are certain issues that the permittee may need to pay attention to before they become problems in the future. The compliance officer will make note of these potential issues and the project manager or compliance officer will notify the permittee of the concerns in the acceptance letter for the report. The compliance officer may determine a site visit is necessary prior to accepting a report. On an annual basis, the compliance officer will conduct random site visits on approved activities to evaluate their progression and ensure that the activities are in compliance with the authorization.

[12] At this time the compliance officer is the Environmental Analyst for the Regulatory Branch, Enforcement and Transportation Section.

Determination of Non-Compliance

An activity may be determined to be out of compliance with the authorization if the Corps determines that a report is not acceptable, the activity is failing the interim performance standards, or if the activity has not attained its stated goal at the end of the monitoring period. The Corps will notify the Services of the determination of non-compliance. In coordination with the Services, the Corps will work with the permittee to implement appropriate contingency measures. Contingency measures may include, but are not limited to, those outlined by the permittee in the monitoring plan, revisions to the activity construction and/or design, revisions to the monitoring and performance standards, additional restoration/rehabilitation to compensate for unacceptable adverse impacts, and/or extending the duration of the monitoring. If a permittee declines to voluntarily implement the contingency measures as outlined by the Corps, in coordination with the Services, to avoid or minimize impacts to threatened or endangered species, the activity will be handled as a violation in accordance with enforcement measures outlined in the Corps regulations.

Violation of Programmatic Consultations Conditions

To ensure compliance with the programmatic consultation conditions, the Corps will conduct random site evaluations of activities authorized under the programmatic consultation. Through notification by anonymous complainants, the Corps may specifically target an individual activity to determine if it is in compliance with the conditions as authorized under the programmatic consultation. If the Corps determines that a permittee is in violation of the programmatic consultation requirements or has deviated from the authorization, the Corps will proceed with an enforcement action against the permittee, in coordination with the Services. In some instances, the Corps, in coordination with the Services, may cite the contractor with a violation, if the contractor is repeatedly involved in deviations of permit conditions or violations.

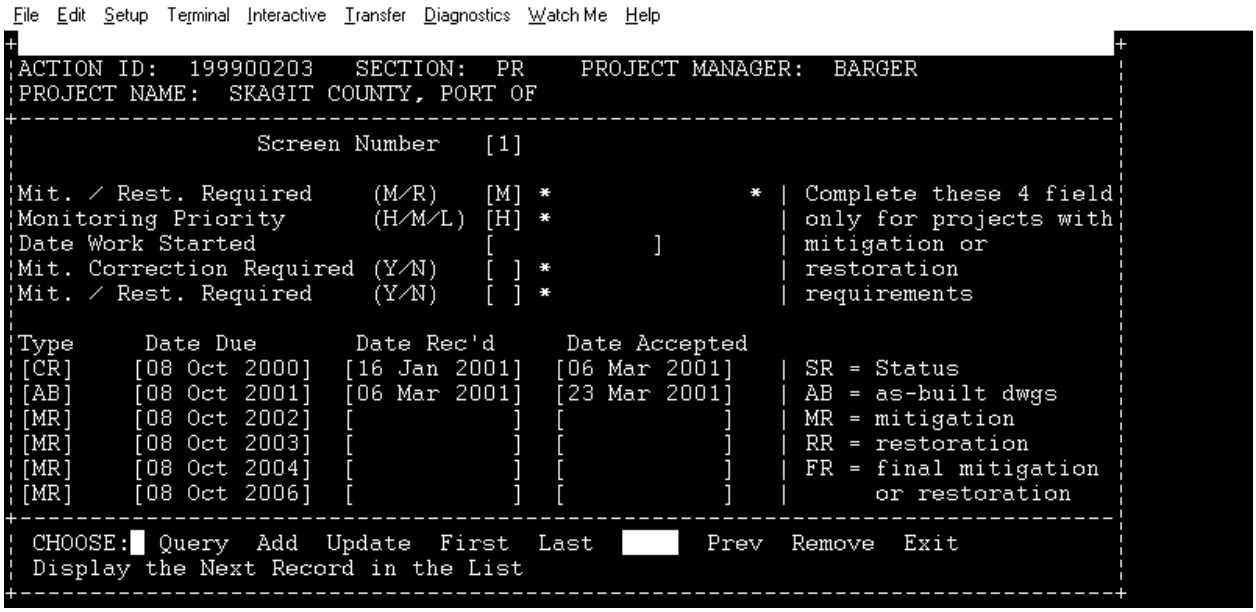
Enforcement actions may include revocation of the Department of the Army permit, removal of the constructed activity, and/or fines.

If a permittee is in violation of the programmatic consultation conditions or has caused unauthorized take of a listed species, the Services may implement enforcement actions against the permittee as per their regulations and procedures.

D. Programmatic Tracking and Reporting:

The Corps will submit regular tracking reports to the Services outlining the use of the programmatic consultation. For the first year after implementation of the programmatic consultation, the Corps will submit a tracking report at the end of three months, six

Table III-3: Tracking Compliance Reports



months and one year. After the first year, tracking reports will be submitted on an annual basis for the duration of the programmatic consultation.

The tracking reports shall include:

- Activities Authorized:
  - List of all the activities authorized under the programmatic consultation showing Corps reference number, permittee's name, date of approval, and permitting procedure used (NWP, RGP, LOP, IP).
  - List of permits authorized under the programmatic consultation by activity (i.e. removal of fish passage barrier, in-stream restoration, etc.).

- Compliance and Enforcement Actions:
  - Discussion of which projects were modified from what was originally authorized and how.
  - Discussion of any enforcement actions taken on projects authorized by the programmatic consultation and how they were resolved.

- Activities not Authorized:
  - Discussion of types of restoration/rehabilitation activities that did not qualify for the programmatic consultation and why.

- Individual Project Monitoring:
  - All as-built drawings, post-construction impact assessments, and monitoring reports submitted for the period covered by the tracking report.
  - A list of permits which have as-built drawings, post-construction impact assessments, and monitoring reports past due.

- Evaluation of the Project Success
  - Success of the project(s) to meet restoration/rehabilitation objective.
  - Failure of the project(s) to meet restoration/rehabilitation objective.
  - Unforeseen impacts associated with the project(s) short- and long-term.
  - Activities less impacting than anticipated in the programmatic consultation.

- Proposed Programmatic Consultation Revisions and/or Modifications:
  - Recommendation as to whether the programmatic should be revised to include additional activities or exclude previously authorized activities.

The Corps and the Services will meet at least annually by December 31 of each year to review the tracking reports and determine if revisions or addendums to the programmatic consultation are necessary. If revisions or addendums are proposed, the Corps will reinitiate consultation with Services to approve the revisions or addendums to the programmatic consultation. The Services will respond in writing to any changes made to the programmatic consultation.

Revisions based on Evaluation of Programmatic Consultation Success

Revisions and Addendums to Programmatic Requirements: The Corps and the Services will specifically discuss exclusions, alterations, modifications, and/or additions to the programmatic consultation conservation measures made during the site-specific project review. If programmatic consultation requirements are consistently being excluded, altered, modified and/or added, the programmatic consultation will be revised to reflect these changes.

Post Construction Impact Assessments: If the "post construction impact assessments" consistently identify activities that are less impacting than assessed within the programmatic consultation, the Corps and the Services will revise the programmatic consultation to reflect the change of impact. Conversely, if the "post construction impact assessments" consistently identify activities that are more impacting than assessed within the programmatic consultation, the Corps and the Services will revise the programmatic consultation to reflect the change of impact.

Addendums: The Corps may propose addendums to the programmatic consultation for any activities previously unidentified or not covered under the programmatic consultation as long as appropriate biological evaluations are provided for those

activities. The Corps will not consider these activities to be included in the approved programmatic consultation until the Services have provided addendum Programmatic Biological Opinions addressing those activities.

Rescinding the Programmatic Consultation: At any time in the life of the programmatic consultation, the Corps or the Services have the right to rescind the programmatic consultation process. However, the Corps and the Services will first meet to discuss any decisions to rescind the programmatic consultation or portions thereof in an attempt to resolve issues or conflicts. If the issues or conflicts are not resolved by the Programmatic Coordinators for the Corps and the Services, the issue will be elevated for discussion between the Chief of the Corps Regulatory Branch, Federal Activities and/or Endangered Species Unit supervisors of the USFWS, and the appropriate NMFS Team Leader. If the issues are still unresolved, the District Engineer of the Corps, the Chief of the NMFS Washington State Habitat Branch, the Manager of the Western Washington Office, and the Supervisor of the Upper Columbia Office of USFWS shall meet. If the issue remains irresolvable, a decision to rescind the programmatic consultation must be in writing and signed by the Corps District Engineer, the NMFS Washington State Habitat Branch, and/or the USFWS Office Manager/Supervisor.

IV. Affected Environment

For the purposes of this document, Washington State has been separated into five geographic regions: Coastal Washington Watersheds; Puget Sound, Hood Canal, Strait of Juan de Fuca, and Strait of Georgia Watersheds; Lower Columbia River Watersheds; Middle and Upper Columbia River Watersheds; and, Snake River Watersheds.

Discussions of each region includes the U.S. Geological Survey (USGS) Hydraulic Unit Codes (HUC) included within the region, the federally listed and proposed species present in the region, discussion of major land use activities within the region, Clean Water Act 303(d) listed waters within the region, and, if available, a summary of the

Limiting Factors Watershed Studies completed by Water Resource Inventory Area (WRIA).

Washington State

Washington State supports 5.8 million people, with 46 animals and 10 plants listed as threatened or endangered under the Endangered Species Act of 1973, as amended. The majority of these species are dependent upon the aquatic environment for survival.[13]

Over 3,000 miles of marine shoreline exist in Washington State (including 2,400 miles with the Puget Sound estuary) with extensive freshwater habitat, including 8,000 freshwater lakes. Since the early 1800's with the arrival of Euro-American immigration, 50 to 90% of riparian habitat has been lost or extensively modified within the state.[14] Originally supporting 1.4 million acres of wetlands, the total wetland area in the state as of 1989 was reduced to 938,000 acres – a loss of 33 percent.[15] Fifty-five hydroelectric facilities occur in the Columbia River basin and 1,025 dams exist within the state.[16] Washington State also supports 48 ports in 26 counties. The ports vary in size with Seattle and Tacoma as the two largest ports in the state.[17]

In addition to loss of habitat, water quality has been significantly altered throughout the state. Close to 60 percent of the lakes, streams, and estuaries surveyed within Washington State do not meet water quality standards.[18] Excessive levels of fecal coliform[19] and other nutrients, elevated temperatures[20], and increased sedimentation levels[21] occur in 2 percent of the lakes, rivers and estuaries of the state.[22] Washington

[13] WDNR (2000), p. 105
[14] WDNR (2000), p. 42
[15] Canning, D.J. and M.L. Stevens (1990)
[16] WDNR (2000), p.24
[17] WDNR (2000), p. 69.
[18] Ecology (2000)
[19] Affecting 44% of the identified polluted waters in the State. [Ecology (2000)]
[20] Affecting 44% of the identified polluted waters in the State. [Ecology (2000)]
[21] Affecting 40% of the identified polluted waters in the State. [Ecology (2000)]
[22] WDNR (2000), p. 79

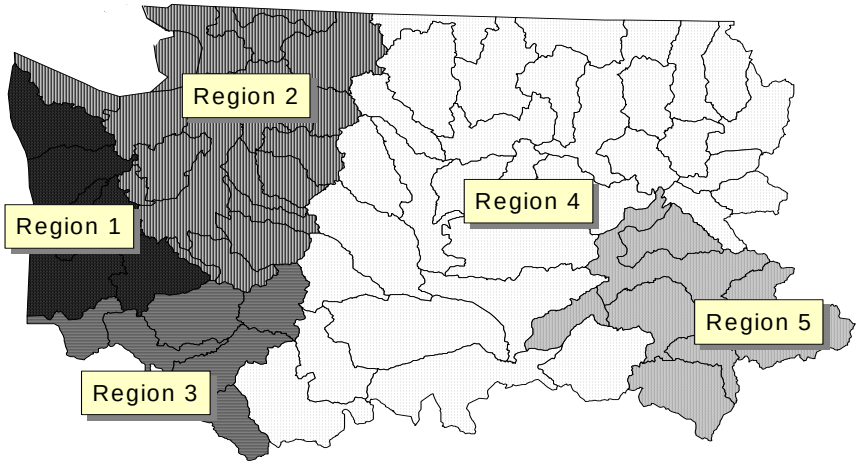
State discharged a total of 1.5 million pounds of cancer-causing pollutants directly into the water between 1992 and 1996, the highest level in the nation.[23] A total of 38 drinking water sources within the state have been identified as contaminated by agricultural related chemicals and chemicals associated with industrial practices.[24] In addition to water contamination, 112 sites within the state have been identified as areas in need of clean up or areas of concern by the Washington Department of Ecology – 93 sites are in saltwater areas and 19 sites are in freshwater areas.[25] Contamination sources have been identified as 52% associated with industrial activities (including production of pulp, paper, chemicals, petroleum refining, and transport and storage), 13% associated with combined sewer outflows, 11% associated with Navy operations, and 10% associated with storm water.[26]

For the purposes of this document, the state has been separated into distinct watersheds for more detailed analysis (Figure IV-1).

Figure IV-1: Map of Affected Environment Regions

Legend:

Region 1 - Coastal Washington Watersheds
Region 2 – Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds
Region 3 – Lower Columbia River Watersheds
Region 4 – Middle and Upper Columbia River Watersheds
Region 5 – Snake River Watersheds



Region 1 – Coastal Washington Watersheds:

Geographic Boundaries

The Coastal Washington Watersheds include:

- Hoh-Quillayute watershed [HUC[27] 17100101, and WRIA[28] 20]
- Queets-Quinault watershed [HUC 17100102, and WRIA 21]
- Upper Chehalis River watershed [HUC 17100103 and WRIA 23], and
- Lower Chehalis River watershed [HUC 17100104 and WRIA 22]
- Grays Harbor watershed [HUC 17100105 and WRIA 22]
- Willapa Bay watershed [HUC 17100106 and WRIA 24].

The watersheds stretch into Clallam, Grays Harbor, Jefferson, Lewis, Mason, Pacific, and Thurston Counties.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species descriptions and the factors to their decline, see Appendix A.

Birds:

• Bald eagle *(Haliaeetus leucocephalus)*	Threatened
• Brown pelican *(Pelecanus occidentalis)*	Endangered
• Marbled murrelet *(Brachyramphus marmoratus)* Designated critical habitat	Threatened
• Northern spotted owl *(Strix occidentalis caurina)* Designated critical habitat	Threatened
• Short-tailed albatross (*Phoebastria albatrus*)	Endangered
• Western snowy plover *(Charadrius alexandrinus nivosus)* Designated critical habitat	Threatened

Fish:

• Coastal/Puget Sound Bull trout (*Salvelinus confluentus*)	Threatened
• Ozette Lake Sockeye (*Oncorhynchus nerka)* Designated critical habitat	Threatened
• SW Washington/Columbia River/Coastal Cutthroat Trout (*Oncorhynchus clarki clarki)*	Threatened (Proposed)
• Coastal/Puget Sound Dolly Varden (*Salvelinus malma)*	Threatened (Proposed)

[27] Hydrologic Unit Code (HUC)
[28] Water Resource Inventory Area (WRIA)

Insects:

- Oregon silverspot butterfly (*Speyeria zerene hippolyta*) Threatened
  [Pacific County only]

Mammals [in Lewis County only]:

- Canada lynx (*Lynx canadensis*) Threatened
- Gray wolf *(Canis lupus)* Endangered
- Grizzly bear *(Ursus arctos horribilis)* Threatened

Marine Mammals:

- Blue Whale (*Balaenoptera musculus)* Endangered
  [Pacific Ocean only]
- Fin Whale (*Balaenoptera physalus)* Endangered
  [Pacific Ocean only]
- Humpback Whale (*Megaptera novaeangliae)* Endangered
  [Pacific Ocean only]
- Sei Whale (*Balaenoptera borealis)* Endangered

[Pacific Ocean only]

- Sperm Whale (*Physeter macrocephalus)* Endangered
  [Pacific Ocean only]
- Steller Sea Lion (*Eumetopias jubatus)* Threatened

Plants:

- Golden paintbrush (C*astilleja levisecta)* Threatened
  [Thurston County only]
- Kincaid's lupine (*Lupinus sulphureus kincaidii*) Threatened
  [Lewis County only]
- Nelson's checker-mallow (*Sidalcea nelsoniana)* Threatened
  [Lewis County only]

Reptiles [Pacific Ocean only]:

- Green sea turtle *(Chelonia mydas)* Threatened
- Leatherback sea turtle *(Dermochelys coriacea)* Endangered
- Loggerhead sea turtle *(Caretta caretta)* Threatened

Land Use Activities

Timber Harvest

The majority of the lands in Coastal Washington Watersheds are in timber production. Impacts associated with timber harvesting to listed fish species include: sedimentation and erosion problems associated with logging roads, fish passage barriers associated with logging roads, mass wasting resulting in sedimentation in spawning grounds,

elimination of spawning and rearing habitat, elimination of downstream recruitment of spawning gravels and large woody debris (LWD), loss of channel complexity through the removal of LWD, riparian vegetation that provides cover and temperature control to streams.[29] Many of the streams located in areas managed for forest production have been listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedances and low dissolved oxygen levels. (See Table IV-1)

In order to assess impacts that have occurred to salmonids in Washington State and better prioritize restoration efforts, Washington Conservation Commission is preparing limiting factors reports for each Water Resource Inventory Area (WRIA). To date, limiting factors reports have been completed for the Hoh-Quillayute Watershed (WRIA 20) and the Willapa Bay Watershed (WRIA 22). Other watersheds in Coastal Washington are still under review. As outlined in Table IV-2, the studies determined that timber harvesting has resulted in the following impacts: numerous blockages due to logging roads, high water temperatures and lack of in-stream structure (LWD) due to removal of riparian vegetation with timber harvesting, high sediment levels associated with high unpaved logging road densities, and poor hydrologic maturity due to loss of "fog drip" from large conifers, altering the hydrology in the area. Timber activities have also resulted in impacts downstream in the estuarine habitats, especially in the Quillayute estuary, through increased sedimentation and water flows.

Impacts associated with timber harvesting to listed bird and mammal species include: removal of trees and habitat suitable for nesting, foraging and perching, and removal of habitat corridors and foraging areas for listed mammals. Due to past development and forest management practices, potential spotted owl and marbled murrelet nesting habitat has decreased to about 12% of historic levels.[30]

[29] Myers, et al, (1998)
[30] U.S. Forest Service (2000). p. 35

Agricultural and Aquacultural Production

Large portions of the Chehalis watershed have been altered by diking, irrigation and land-clearing for the purposes of agricultural and cattle production. Hydrology and vegetation in the Long Beach Peninsula and Grayland area (Grays Harbor) have been significantly altered for the primary purpose of cranberry production. Impacts associated with agricultural activities to listed fish species include: widespread removal of riparian vegetation, rerouting of streams, sedimentation and erosion control impacts associated with streambank degradation, impacts to hydrology through extensive summer water withdrawals, introduction of water quality contaminants from pesticides, herbicides, and livestock waste, elimination of spawning and rearing habitat, elimination of downstream recruitment of spawning gravels and LWD, and separation of side channels and rearing channels from main stream channels by diking and irrigation canal construction.

Many streams in the areas dominated by agricultural activities are listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedances, low dissolved oxygen levels, and high fecal coliform levels (associated with cattle production). In the Grayland area and Long Beach Peninsula, the waterways are listed under Section 303(d) of the Clean Water Act as impaired for chemical contamination associated with herbicide and pesticide application used in cranberry production. (See Table IV-1) As outlined in Table IV-2, the Washington Conservation Commission limiting factors reports for WRIA 20 and 24 identified the following impacts associated with agricultural production: invasive plant dominance - such as reed canary grass, hardening banks of incised channels, limiting creation of instream complexity, poor LWD and riparian conditions, loss of connectivity between channels and floodplain and rearing habitats by channel incisions and diking, loss of estuary habitat from tide gates, diking and armoring, increased water temperatures and resulting increase predator habitat, alteration of wetlands from irrigation and draining, dams for irrigation, and fish passage barriers from road crossings and tide gates.

Willapa Bay and Grays Harbor have experienced introduction of contaminants and exotic plant species invasions associated with the shellfish harvesting industry. Approximately 47,000 acres of intertidal mudflats exist in Willapa Bay, 3,250 acres were covered with spartina in 1997 (a 60% increase from measurements taken in 1994). If left uncontrolled, predictions for spartina coverage is estimated at 30,000 acres by 2030.[31] Spartina was introduced into western Washington as a packing material for shipments of oyster seedlings sent from the east Coast in 1894 is start the oyster industry in Willapa Bay.[32] Spartina meadows trap sediments in the intertidal area, keeping the sediments from drifting into the bay. Spartina meadows displace mudflats and open intertidal habitat with monocultured salt marshes and deep, narrow tidal channels.[33]

Impacts from agricultural and aquacultural activities to listed birds and mammal species include: removal of nesting, perching and foraging areas through removal of vegetation and change to monoculture habitats, removal of foraging and nesting areas for shorebird migrations, removal of shoreline habitat through diking and draining of tidal marshes, removal or impairment of habitat corridors, chemical contamination impacts through increased contaminant levels in forage species, and increased habitat for predators.

Urban Development

Urban development in the Coastal Washington Watersheds is relatively small in comparison to other areas of Western Washington. Urban development is centered around Centralia/Chehalis in the Upper Chehalis watershed, Aberdeen/Hoquiam in the Grays Harbor watershed, Raymond/South Bend in the Willapa Bay watershed, Long Beach/Ilwaco on the Long Beach Peninsula with smaller scale development in Forks and LaPush on the Olympic Penninsula. Regular dredging of navigation channels are conducted in Willapa Bay, Grays Harbor and Baker Bay (mouth of the Columbia River). In addition to the impacts associated with agricultural and timber harvesting, impacts

[31] WDNR (2000), p. 50.
[32] Frenkle, R.E., Kunze, L.M. (1984).
[33] WDNR (2000), p. 50.

from urbanization to listed fish species also include: removal of stream habitat through tightlining and channelization, impacts to hydrologic regimes and increased "flash flooding" through increased impervious surface and stormwater runoff, loss of floodplains and tidal/estuarine habitat through diking and tidegate placements, loss of estuarine intertidal habitat through dredging and placement of man-made structures, and impacts to water quality through chemical contamination associated with industrial activities and septic and sewer discharge.

Probably the most significant urban development impact to southwestern coastal watersheds of Washington State comes from development in the form of hydropower dams on the Columbia River. Prior to the construction of the dams, 1.2 million cubic yards of debris and sediment traveled down the Columbia River, replenishing the beaches of Wasington State north to Copalis Head and south into Oregon at Tillamook Head.[34] All this material is now trapped behind the series of dams. Long Beach Peninsula is already experiencing beach erosion due to the loss of the sediment supply from the Columbia River.[35]

Waterbodies in the urban development areas are listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedances, low dissolved oxygen levels, fecal coliform (from septic and sewer discharge), and chemical contaminants associated with transformers and the Satsop nuclear plant operation. (See Table IV-1) As outlined in Table IV-2, Washington Conservation Commission identified the following limiting factors associated with urban development in WRIA 20 and 24: extremely limited and altered estuarine habitats from dredging, tide gates, diking, bank armoring and draining, loss of floodplain connectivity from roads in riparian corridors, loss of riparian habitat, and alteration of wetlands through filling or draining. Due primarily to urbanization and related industrial and commercial development, Grays Harbor has lost 3,840 acres of marsh[36] and 14,579 acres (30%) of aerial extent of estuarine habitat.[37]

[34] Corps (1999)
[35] White, G. (2000)
[36] Seliskar and Gallagher (1983)
[37] NRCC (1996)

In Willapa Bay, 6200 acres (40%) of emergent marsh has been lost[38], 2600 acres of vegetated wetlands[39] lost, 6300 acres of tidelands and marshlands lost to industry and highways, 300 acres tidelands and marshlands lost to agriculture, 6600 acres tidelands and marshlands lost to pasture, hay, and silvaculture production.[40]

Additional impacts to listed birds, insects, and mammals from urban development include loss of essential breeding habitat through loss or conversion of estuarine habitat, introduction of invasive plant species, increase in habitat for predators, and harassment and disturbance from increased human activity. Grays Harbor and Willapa Bay estuaries occur within the Pacific Flyway, the main flight corridor for migrating shorebirds along the West Coast. Over 1 million migrating birds have been documented in a single season in Grays Harbor, mostly at Bowerman Basin. Bowerman Basin is the first available resting area in Grays Harbor for migrating birds but only accounts for 2% of the estuary.[41] For the Long Beach Peninsula and Grays Harbor, European Beachgrass is a primary culprit for the loss of Oregon silverspot butterfly habitat and western snowy plover habitat.[42] Habitat losses associated with European Beachgrass is exacerbated by narrowing beaches as source sediments for the Long Beach Peninsula beaches from the Columbia River has been virtually haulted by existing dams on the Columbia River.[43]

Protected areas

The following federally protected areas occur in the Coastal Washington Watersheds: Grays Harbor National Wildlife Refuge (1,800 acres), Washington Island National Wildlife Refuge (Copalis, Quillayute Needles, Flattery Rocks), Willapa Bay National Wildlife Refuge (11,000 acres), Buckhorn Wilderness (216 acres), Colonel Bob Wilderness (11,961 acres), Olympic National Park, Olympic National Marine Sanctuary (3,300 square miles), Olympic National Forest, and Snoqualmie National Forest.

[38] Seliskar and Gallagher (1983)
[39] Boule and Bierly (1987)
[40] Phillips (1984)
[41] WDNR (2000), p. 46
[42] Final Listing of Western Snowy Plover, March 5, 1993 (64FR 68507-68544) and Final Listing of Oregon Silverspot Butterfly, July 2, 1980 (45FR 44935-44939)
[43] WDNR (2000), p. 73.

The following Washington State protected Natural Area Preserves (NAP) occur in the Coastal Washington Watersheds: Bald Hill (Thurston County – 314 acres), Bone River (Pacific County – 2,453 acres), Carlisle Bog (Grays Harbor County – 310 acres), Chehalis River Surge Plain (Grays Harbor County – 2,330 acres), Goose Island (Grays Harbor County – 12 acres), Gunpowder Island (Grays Harbor County – 152 acres), Mima Mounds (Thurston County – 445 acres), Niawiakum River (Pacific County – 837 acres), North Bay (Grays Harbor County – 1,043 acres), Sand Island (Grays Harbor County – 8 acres), Whitcomb Flats (Grays Harbor County – 5 acres), and Willapa Divide (Pacific County – 272 acres). The following Washington State protected Natural Resource Conservation Areas (NRCAs) occur in the Coastal Washington Watersheds: Elk River (Grays Harbor County – 3,800 acres), South Nemah (Pacific County – 1,452 acres), South Nolan (Jefferson County – 213 acres), and Teal Slough (Pacific County – 8.5 acres). The following Washington State Wildlife Areas, protected by Washington Department of Fish and Wildlife occur in the Coastal Washington Watersheds: Johns River Wildlife Area (Grays Harbor County – 1,500 acres), Chehalis Wildlife Area (Grays Harbor County – 527 acres), and Olympic Wildlife Area (Grays Harbor County – 1,500 acres).

Private protected lands in Coastal Washington Watersheds include: The Nature Conservancy - Black River Preserve (Thurston County – 320 acres); Chehalis River Basin Land Trust (Grays Harbor County); and the Columbia Land Trust.

Impaired Waterbodies

All or portions of the following waterbodies listed in Table IV-1 have been listed under Section 303(d) of the Clean Water as impaired waterways. The parameter(s) exceeded are noted for each waterbody. Full extents of the listed waterbodies may be obtained from Washington State Department of Ecology in the “Final 1998 Section 303(d) Listed Waterbodies for Washington State”, dated April 4, 2000.

Table IV- 1: Section 303(d) Listed Waterbodies in Coastal Washington Watersheds

Source: Final 1998 Section 303(d) List, Washington State Department of Ecology, April 4, 2000.

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
20	ALDER CREEK	Temperature
20	ANDERSON CREEK	Temperature
20	BEAVER CREEK	Temperature
20	BOGACHIEL RIVER	Dissolved Oxygen, Temperature
20	CANYON CREEK	Temperature
20	COAL CREEK	Temperature
20	CROOKED CREEK, N.F.	Temperature
20	DICKEY RIVER, E.F.	Temperature
20	DICKEY RIVER, M.F.	Temperature
20	DICKEY RIVER, W.F.	Temperature
20	ELK CREEK	Temperature
20	FISHER CREEK	Temperature
20	LAKE CREEK	Dissolved Oxygen, Temperature
20	LINE CREEK	Temperature
20	MAPLE CREEK	Temperature
20	MAXFIELD CREEK	Temperature
20	NOLAN CREEK	Temperature
20	OWL CREEK	Temperature
20	ROCK CREEK	Temperature
20	SOLEDUCK RIVER	Dissolved Oxygen, Temperature
20	SPLIT CREEK	Temperature
20	TOWER CREEK	Temperature
20	WILLOUGHBY CREEK	Temperature
20	WINFIELD CREEK	Temperature
21	JOE CREEK	Dissolved Oxygen, Fecal Coliform
21	KALALOCH CREEK (W.F.)	Temperature
22	BLACK CREEK	Temperature
22	CHEHALIS RIVER	Fecal Coliform, Temperature
22	GRAYS HARBOR (INNER)	Fecal Coliform
22	GRAYS HARBOR (OUTER)	Fecal Coliform
22	GRAYS HARBOR CO. DRAINAGE DITCH NO. 1 (GHCDD-1)	4,4'-DDD, Azinphos-Methyl, Carbaryl Diazinon, Parathion
22	HUMPTULIPS RIVER	Temperature
22	RABBIT CREEK	Temperature
22	WILDCAT CREEK	Temperature
22	WYNOOCHEE RIVER	Temperature
23	BERWICK CREEK	Fecal Coliform
23	BLACK LAKE	Total Phosphorus
23	BLACK RIVER	Temperature
23	CHEHALIS RIVER	Fecal Coliform, PCB-1254, Temperature
23	CHEHALIS RIVER, S.F.	Temperature
23	DEMSEY CREEK	Dissolved Oxygen, Fecal Coliform
23	DILLENBAUGH CREEK	Fecal Coliform, Temperature
23	ELK CREEK	Fecal Coliform
23	LINCOLN CREEK	Fecal Coliform, Temperature

Table IV-1

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
23	NEWAUKUM RIVER	Fecal Coliform, Temperature
23	SALZER CREEK	Fecal Coliform, Temperature
23	SCATTER CREEK	Fecal Coliform, pH, Temperature
23	SKOOKUMCHUCK RIVER	Fecal Coliform, pH, Temperature
24	ELKHORN CREEK	Temperature
24	FORK CREEK	Temperature
24	GRAYLAND DITCH	Dissolved Oxygen, Fecal Coliform
24	JOE CREEK	Temperature
24	LITTLE NORTH RIVER	Temperature
24	NASELLE RIVER	Temperature
24	NORTH RIVER	Fecal Coliform, Temperature
24	NORTH RIVER, E.F.	Temperature
24	PACIFIC COUNTYDRAINAGE DITCH NO. 1 (PCDD-1)	4,4'-DDD,Azinphos-Methyl, Carbaryl Chlorpyrifos, Diazinon
24	SALMON CREEK, UPPER	Temperature
24	SMITH CREEK	Temperature
24	UNNAMED CREEK (trib. to North River)	Temperature
24	WILLAPA BAY	Fecal Coliform, Dissolved Oxygen
24	WILLAPA RIVER	Fecal Coliform, Temperature

Table IV-2: WRIA 20 & 24 Salmonid Species Limiting Factors by Basin

Source: Washington Conservation Commission (http://www.conserver.org/salmon/index.php3)

WRIA	BASIN	LIMITING FACTOR
20	Waatch Watershed	• Fish passage blockage/logging roads • High water temperatures • Lack of marine-derived nutrients
20	Sooes Watershed	• Fish passage blockage/logging roads • High water temperatures • Lack of marine-derived nutrients
20	*Snag Creek* *Thirty Cent Creek*	• Riparian floodplain impacts
20	Ozette Watershed	• "Poor" LWD & riparian conditions • Warm water temperatures • Poor hydrologic maturity (loss of fog drip from large conifers & change in hydrology) • Altered estuary • Lack of marine-derived nutrients
20	*Lake Ozette*	• Reduced water level fluctuations/Cleared LWD in Ozette River • Invasive plant domination: Reed Canary Grass • High levels of fine sediments
20	*Umbrella Creek* *Big River* *Siwash Creek*	• High levels of fine sediments/High road densities • Incised channels • Banks hardened w/ Reed Canary grass
20	Quillayute Watershed	• Estuary significantly altered by dredging, armored & diked banks • Important surf smelt spawning grounds & salmonid rearing habitat for WRIA 20 • Increased sedimentation & water flows(upstream)
20	*Dickey*	• High sedimentation levels associated with logging roads • High windthrow destruction due to lack of riparian buffers from timber harvesting • Warm water temperatures/increase in squawfish distribution (salmonid predators) • Fish passage blockages/logging roads • Poor hydrologic maturity (loss of "fog drip" from large conifers & change in hydrology) • Altered wetlands due to increase road sedimentation & loss of wetland riparian vegetation • Decreased low levels of LWD in streams (lack of contribution & wash out due to flooding) • riparian road impacts in flood plain

Table IV-2

WRIA	BASIN	LIMITING FACTOR
20	*Soleduck River*	• excessive sedimentation associated with landslides & high road densities • degradation of spawning habitat from high levels of fine sediments • "Poor" LWD & riparian conditions • Loss of wetland & off-channel habitat • Warm water temperatures • Over-allocation of water from the river • "poor" hydrologic maturity (loss of fog drip from large conifers & change in hydrology) • Fish passage blockages due to roads • Upper reaches in ONP excellent
20	*Calawah*	• extensive landslide problems related to old logging roads • Side-cast roads & high densities of roads • Excessive sedimentation causing dewatering of Hyas Creek, NF Sitkum River & Rainbow Creek • Channel instability associated with excessive sedimentation, low levels of LWD & riparian road impacts • Floodplain problems from channel incision & riparian roads • Warm water temperatures • "Poor" LWD recruitment conditions
20	*Bogachiel River*	• "poor" LWD & riparian conditions • Aggraded mainstem that worsens downstream • Collapsing banks in lower mainstem, introduction of fines from exposed clay degrading spawning habitat • Warm water temperatures • Upper reaches in ONP excellent condition
20	Goodman Creek	• Sedimentation & altered riparian conditions • Low levels of LWD
20	Mosquito Creek	• Sedimentation & altered riparian conditions
20	Hoh River	• debris flows resulting in scoured, incised channels with few spawning gravels & LWD • Channel incision exposing clay layers & contributing fines • High sedimentation loads from mass wasting & road erosion • "Poor" LWD & riparian conditions • Fish passage blockages - culverts & cedar spalts • Degradation of water quality from spalts • Loss & degradation of floodplain complexes

Table IV-2

WRIA	BASIN	LIMITING FACTOR
		• Riparian roads within the floodplain • Poor hydrologic maturity (loss of fog drip from large conifers & change in hydrology) • Upper watershed in ONP excellent conditions
20	Cedar Creek	• Sedimentation & altered riparian conditions • Fish passage blockages from culverts & spalts
20	Steamboat Creek	• Sedimentation & altered riparian conditions • Fish passage blockages from culverts & spalts
24	Cedar River	• Tide gates as fish passage blockages
24	North River	• low level of LWD • Poor riparian conditions • Excessive sediment inputs from high road densities • Loss of estuary habitat from dikes & tidegates • Fish passage blockages – culverts • Channel incision – disconnecting river,. Floodplain & rearing habitat. Caused by peak water flows & lack of LWD • Warm water temperatures • Poor shading from altered riparian zones
24	*Vesta Creek* *Little North River* *Redfield Creek*	• naturally low levels of gravel recruitment limiting available spawning habitat • Lack of LWD • Pool habitat below adequate levels caused by lack of LWD
24	Smith Creek	• low levels of spawning gravels • low levels of LWD • High sedimentation levels from logging roads & landslides
24	Willapa Watershed	• lack of LWD • Highest road densities, greatest number of roads crossing streams, greatest quantity of road in riparian areas within WRIA 24 • High sediment loads from mass wasting & road densities • Sedimentation reducing (filling) pool habitat & increasing fines, scour & channel incision • Naturally low levels of recruitment of spawning gravels aggravated by lack of LWD to store gravel • Excessive channel scour • Poor riparian conditions • Warm water temperatures • Low dissolved oxygen • Estuary habitat barrier from tide gates • Loss of 19% of estuary habitat from diking w/ urban development

Table IV-2

WRIA	BASIN	LIMITING FACTOR
		• Channel incision segregating channel from floodplain & rearing habitat • Impact from water withdrawals • Dam on Stringer creek limiting spawning gravel recruitment
24	Palix Watershed	• lack of stable LWD • High road densities & road sediment inputs • Extensive channel incision • High level of estuarine habitat loss from diking (31% of historic estuarine wetlands lost) • Small number of fish passage blockages – culverts • High water velocity in the winter (improve w/ LWD placement)
24	Nemah Watershed	• high inputs of fine sediment from forest roads • poor riparian conditions • lack of LWD • floodplain loss due to riparian roads • mass wasting related to roads • loss of estuarine wetlands due to diking • loss of riparian shade/canopy in lower reaches • fish passage blockages – culverts
24	Nasselle Watershed	• lack of LWD • poor riparian conditions (44% of riparian consists of hardwoods, open or young conifers) • large number of fish passage blockages – culverts, tidegates, & riparian roads • sedimentation from large number of landslides & roads (Salmon Creek) • high water temperatures in summer • estuary loss due to diking • reduction in hydrologic maturity (loss of fog drip from large conifers & change in hydrology)
24	Bear River Watershed	• lack of LWD • excessive sedimentation from landslides & roads • immature riparian forest • reduction in hydrologic maturity (loss of fog drip from large conifers & change in hydrology) • some fish passage blockages – culverts

Region 2 - Puget Sound, Hood Canal, Strait of Juan de Fuca, and Strait of Georgia Watersheds

Geographic Boundaries

The Puget Sound, Hood Canal, Strait of Juan de Fuca, and Strait of Georgia Watersheds include:

- Fraser watershed [HUC[44] 17110001, and WRIA[45] 01]
- Strait of Georgia watershed [HUC 17110002, and WRIA 01 and 03]
- San Juan Islands watershed [HUC 17110003 and WRIA 02]
- Nooksack watershed [HUC 17110004 and WRIA 01]
- Upper Skagit watershed [HUC 17110005 and WRIA 04]
- Sauk watershed [HUC 17110006 and WRIA 04]
- Lower Skagit watershed [HUC 17110007 and WRIA 05]
- Stillaguamish waters93hed [HUC 17110008 and WRIA 05]
- Skykomish watershed [HUC 17110009 and WRIA 07]
- Snoqualmie watershed [HUC 17110010 and WRIA 07]
- Snohomish watershed [HUC 17110011 and WRIA 07]
- Lake Washington watershed [HUC 17110012 and WRIA 8]
- Duwamish watershed [HUC 17110013 and WRIA 9]
- Puyallup watershed [HUC 17110014 and WRIA 10]
- Nisqually watershed [HUC 17110015 and WRIA 11]
- Deschutes watershed [HUC 17110016 and WRIA 13]
- Skokomish watershed [HUC 17110017 and WRIA 14]
- Hood Canal watershed [HUC 17110018 and WRIA 16]
- Puget Sound watershed [HUC 17110019 and WRIA 06, 12, 15, and 17]
- Dungeness – Elwha watershed [HUC 17110020 and WRIA 18]
- Crescent – Hoko watershed [HUC 17110021 and WRIA 19]

The watersheds stretch into Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom Counties.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species descriptions and the factors to their decline, see Appendix A.

[44] Hydrologic Unit Code (HUC)
[45] Water Resource Inventory Area (WRIA)

Birds:

- Bald eagle *(Haliaeetus leucocephalus)* Threatened
- Marbled murrelet *(Brachyramphus marmoratus)* Threatened
  Designated critical habitat
- Northern spotted owl *(Strix occidentalis caurina)* Threatened
  Designated critical habitat
- Short-tailed albatross (*Phoebastria albatrus*) Endangered
  [Jefferson County only]

Fish:

- Coastal/Puget Sound Bull trout (*Salvelinus confluentus*) Threatened
- Puget Sound chinook salmon (*Oncorhynchus tshawytscha)* Threatened
  Designated critical habitat
- Hood Canal summer chum (*Oncorhynchus keta)* Threatened
  Designated critical habitat

Insects:

- Oregon silverspot butterfly (*Speyeria zerene hippolyta*) Threatened
  [Clallam County only]

Mammals:

- Canada lynx (*Lynx canadensis*) Threatened
  [North Cascades only]
- Gray wolf *(Canis lupus)* Endangered
  [Cascades only]
- Grizzly bear *(Ursus arctos horribilis)* Threatened
  [Cascades only]

Marine Mammals:

- Humpback Whale (*Megaptera novaeangliae)* Endangered
- Steller Sea Lion (*Eumetopias jubatus)* Threatened

Plants:

- Golden paintbrush (C*astilleja levisecta)* Threatened
  [Jefferson, San Juan, and Thurston Counties only]
- Marsh Sandwort (*Arenaria paludicola)* Endangered
  [King County only]
- Water howellia (*Howellia aquatilis)* Threatened
  [Pierce County only]

Reptiles:

- Leatherback sea turtle *(Dermochelys coriacea)* Endangered

Land Use Activities:

Timber Harvest

Timber harvest occurs throughout the watersheds of Puget Sound and the Straits. The majority of the timber harvesting occurs in the Olympic Peninsula along the Strait of Juan de Fuca, in the Kitsap Peninsula along Hood Canal, and the eastern side of the region in the Cascade Mountains (Mt. Baker National Forests). As shown in Table IV-3, many of the waterbodies within heavily timbered areas exceed state standards for temperature levels and dissolved oxygen. In the WRIAs where timber harvesting was most prevalent (i.e. WRIA 19 – Lyre-Hoko Watershed), streams were impacted by high summer water temperatures, excessive sedimentation and lack of large woody debris due to high densities in forest roads, roads construction in the riparian area, mass wasting, and poor timber management resulting in hardwood dominated riparian areas and/or young conifer stands in large woody recruitment zones. (See Table IV-4). Many small estuaries downstream are impacted by the timber harvesting as well. Excessive sediments enter the waterbody and deposit in the estuary, burying important intertidal habitat such as eelgrass beds.

Clearcutting and other poor timber management activities impact terrestrial species as well as fish species, removing large trees essential for nesting or foraging for avian species, removing cover for mammals and altering habitat for plant species.

Agricultural Production

Agricultural production occurs most frequently in the northern sections of the Region in the Skagit River delta and the Nooksack River Valley, with additional agricultural activities concentrated in the White, Puyallup and Carbon Rivers in south King County and eastern Pierce County and within the Nisqually River valley in south Puget Sound. Smaller agricultural activities exist throughout the Deschutes Watershed, Skokomish Watershed, Kitsap Peninsula and within the rainshadow of the Olympic Mountains in the Dungeness River valley.

Agricultural production has greatly altered the natural environment of the region through diking, draining, clearing, and introduction of chemical contaminants and invasive

species. The Skagit Valley originally supported 40 square miles of tidal estuary wetlands. To date, 37 square miles of wetlands (93%) have been lost due to agricultural diking and conversion – 75% of which was lost before 1889.[46] In 1998, a survey of non-native plant species in Puget Sound identified over 52 invasive species.[47] Invasive species out-compete native species, altering the food web. Invasive plants species may completely overtake fragile habitat, creating large monocultures of the invasive plants. The conversion of natural habitats to agricultural lands impact listed species by removing essential habitats for nesting and/or foraging. For fish species, essential stream and estuarine habitats for many portions of the life stages (spawning, nursery, and forage areas) are significantly altered or lost.

As shown in Table IV-3, the main areas supporting agricultural production exceed state standards for fecal coliform, dissolved oxygen, temperature, pH, Ammonia-N, as well as several chemicals associated with pesticides and herbicides. For both fish and other species that feed on the fish (i.e. bald eagles), excessive levels of pesticides and herbicides in the water column are known to result in decreased survival rates of juveniles, altered reproduction, birth defects, extreme loss of body-weight, slowed growth in young, and changes to fish species composition.[48]

Urban Development

The eastern portion of the region is heavily urbanized supporting the majority of the state's population within I-5 corridor. The majority of the urbanization is centered in the Seattle/Tacoma area but extends south to Olympia and north to Everett. Mount Vernon, Anacortes, and Bellingham are more "satellite" urbanization areas to the north with the main centers of urbanization in the western portion of the region occurring in the Bainbridge Island/ Bremerton, Port Townsend and the Port Angeles/Sequim areas.

Urban development has altered the natural environment through increased impervious surfaces, altered shorelines, embayments and nearshore habitat through waterfront

[46] WDNR (2000), p. 47
[47] Cohen, A. N. et al. (1998)
[48] Voss, F.D. (1999)

development, altered streams through channelization, tightlining, changes in water flows and removal of riparian habitat, and increased chemical contaminants associated with industrial development, sewage treatment, and untreated stormwater runoff.

Excessive impervious surfaces alter stream flows, water temperatures and in-stream habitat. Significant changes to wetlands and stream hydrology occur with 5-8% of a watershed being converted to impervious surfaces.[49] About 20-40% of the urban watersheds in the south Puget Sound area are covered with impervious surface.[50]

Residential urbanization results in increased impervious surface, increased contaminant discharges associated with sewer, septic, lawn and cleaning chemicals, increased stormwater runoff and shoreline modifications. Excessive application of fertilizers for yards and fields and leaking septic fields result in depleted oxygen levels, introduction of pathogens and excessive nutrient levels in the water column. In March 2000, 87 areas in Puget Sound were determined to have dissolved oxygen below the state standards.[51] Seventy percent (70%) of the tidelands and 25% of freshwater shorelines are in private ownership.[52] Within Puget Sound, 800 miles or 1/3 of the shoreline have been modified by urbanization, with 25% in intertidal habitats.[53]

Puget Sound nearshore and estuary environment has been greatly affected by harbor development and recreational boat moorage. Some 95% of the marina slips in Washington State occur in western Washington, with 85% in the Puget Sound region.[54] The major ports in the region include Anacortes, Bellingham, Bremerton, Edmonds, Everett, Friday Harbor, Olympia, Port Angeles and two of the largest ports on the west coast – Seattle and Tacoma. Development associated with shipping activities attributed to a loss of 50% of the original wetlands within the urban bays of Puget Sound. Both Seattle and Tacoma retain less than 5% of the natural intertidal habitat – with a loss of

[49] WDFW (1997)
[50] May, C.W. (1996)
[51] Newton, J.A. et al. (1995)
[52] WDNR (2000), p. 54
[53] WDNR (2000), p. 54
[54] Goodwin, R.F. (1991)

90% of the estuary in Elliott Bay, a loss of 90% of the estuary in Puyallup Delta, and 100% loss of the estuary in Commencement Bay.[55] The Port of Seattle alone owned 350 acres of terminal space in 1990 with a projected expansion of 800 acres by 2010.[56] Industry and port facilities cover approximately 7 miles of dredged and channelized waterway in the lower Duwamish River.[57] Eelgrass beds within Bellingham Bay have declined by 50% over the last 100 years due to waterfront developing including wharf and pier construction, dredging, shoreline modifications, and bottom trawling.[58] The Snohomish River estuary has lost 15% of the original eelgrass beds[59] and 80% of the total estuary.[60] Chemical contaminants associated with harbor development have also greatly impacted the region. Thirty-eight percent (38%) of the tidelands and submerged marine beds in Puget Sound do not meet state Water Quality Standards and 89 sites covering 21% of the tidal area are designated for cleanup through state and/or federal law (See Table IV-3 for list of contaminants by WRIA).[61]

Protected areas

The following federally protected areas occur in the Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds: Dungeness National Wildlife Refuge (631 acres), Nisqually National Wildlife Refuge, Protection Island National Wildlife Refuge (2,817 acres), San Juan National Wildlife Refuge (454 acres), Padilla Bay National Estuarine Research Reserve, Skagit Wild-n-Scenic River (99 miles as Scenic, 58.5 miles as Recreational -- Total of 157.5 miles) [62], Alpine Lakes Wilderness (394,000 acres)[63], Boulder River Wilderness (49,000 acres), the Brothers Wilderness, Clearwater

[55] WDNR (2000), p. 75
[56] Corps (1999)
[57] WDNR (2000), p. 69
[58] Fisher, D. (2000)
[59] Levings, C.D. and Thom, R. (1994)
[60] Estuary loss in the Snohomish Delta is associated with both urban development and agricultural production. WDNR (2000), p. 112.
[61] McFarland, B. (2000)
[62] Designated area: the segment from the pipeline crossing at Sedro-Wooley upstream to and including the mouth of Bacon Creek. The Cascade River from its mouth to the junction of its North and South Forks; the South Fork to the boundary of the Glacier Peak Wilderness Area. The Suiattle River from its mouth to the boundary of the Glacier Peak Wilderness Area at Milk Creek. The Sauk River from its mouth to its junction with Elliott Creek. The North Fork of the Sauk River from its junction with the South Fork of the Sauk to the boundary of the Glacier Peak Wilderness Area.
[63] A portion of Alpine Lakes Wilderness is located in Region 4.

Wilderness (14,600 acres), Glacier Peak Wilderness (576,865 acres)[64], Henry M. Jackson Wilderness (102,673 acres)[65], Mt. Baker Wilderness (117,400 acres), Noisy-Diobsud Wilderness (14,100 acres), San Juan Wilderness (80 islands, 352 acres over 650 square miles), Mt. Skokomish Wilderness (13,015 acres), Wonder Mountain Wilderness (2,349 acres), Mt. Rainier National Park, North Cascades National Park[66], Olympic National Park[67], Mt. Baker –Snoqualmie National Forest, and Olympic National Forest.[68]

The following Washington State protected Natural Area Preserves (NAP) occur in the Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds: Clearwater Bogs (Jefferson County – 504 acres), Cypress Highlands (Skagit County – 1,072 acres), Dabob Bay (Jefferson County – 356 acres), Dailey Prairie (Whatcom County – 229 acres), Kennedy Creek (Mason County – 66 acres), Kings Lake Bog (King County – 309 acres), Kitsap Forest (Kitsap County – 550 acres), Oak Patch (Mason County – 17 acres), Olivine Bridge (Skagit County – 148 acres), Point Doughty (San Juan County – 56 acres), Rocky Prairie (Thurston County – 35 acres), Skagit Bald Eagle (Skagit County – 1,546 acres), Skookum Inlet (Mason County – 105 acres), and Snoqualmie Bog (King County – 111 acres).

Washington State protected Natural Resource Conservation Areas (NRCAs) occur in the Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds include: Cattle Point (San Juan County – 112 acres), Clearwater Corridor (Jefferson County – 2,323 acres), Cypress Island (Skagit County – 5,500 acres), Granite Lakes (Skagit County – 603 acres), Greider Ridge (Snohomish County – 6,700 acres), Hat Island (Skagit County – 91 acres), Lake Louise (Whatcom County – 137 acres), Lummi Island (Whatcom County – 661 acres), Morning Star (Snohomish County – 10,000 acres), Mount Pilchuck (Snohomish County – 9,600 acres), Mount Si (King County – 8,000 acres), Rattlesnake Mountain Scenic Area (King County – 1,771 arces),

[64] A portion of Glacier Peak Wilderness is located in Region 4.
[65] A portion of Henry M. Jackson Wilderness is located in Region 4.
[66] A portion of the North Cascades National Park is located in Region 4.
[67] A portion of Olympic National Park is located in Region1.
[68] A portion of Olympic National Forest is located in Region 1.

Shipwreck Point (Clallam County – 471 acres), West Tiger Mountain/Tradition Plateau (King County – 4,500 acres), and Woodard Bay (Thurston County – 600 acres).

Washington State Wilderness areas are protected by Washington Department of Fish and Wildlife in the Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds are as follows: Cherry Valley Wildlife Area (King County – 386 acres), Crescent Lake (Snohomish County – 360 acres), Ebey Island Wildlife Area (Snohomish County – 417 acres), McNeil Wildlife Area (Pierce County – 3,119 acres), Lake Terrell Wildlife Area (Whatcom County – 1,595 acres), Scatter Creek Wildlife Area (Thurston County), Skagit Wildlife Area (Skagit County – 12,761 acres), South Puget Sound Wildlife Area (Pierce County – 90 acres), Spencer Island (Snohomish County – 412 acres), Stillwater Wildlife Area (King County – 456 acres), and Tenant Lake Wildlife Area (Skagit County – 100 acres).

Private protected lands in the Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds include: The Nature Conservancy - Cyrus Gates Memorial/Chuckanut Island (Whatcom County), Foulweather Bluff (Kitsap County – 100 acres), Skagit River (Skagit County – 6,000 acres), Yellow Island (San Juan County – 10 acres), Bainbridge Island Land Trust (Kitsap County), Capitol Land Trust (Thurston County), Great Peninsula Conservancy (Kitsap County), Heritage Land Trust (King County), Jefferson Land Trust (Jefferson County), Lummi Island Heritage Trust (Whatcom County), Mountains to Sound Greenways Trust (King County), North Olympic Land Trust (Clallam County), PCC Farmland Trust (King County), Puget Sound Farm Trust (King County), Save Habitat and Diversity of Wetlands Organization (King County), Skagit Land Trust (Skagit County), Skagitonians to Preserve Farmlands (Skagit County), Trust for Public Lands, Northwest (Western Washington), Vashon-Maury Island Land Trust (King County), Washington Wildlife Foundation (Western Washington), Whatcom Land Trust (Whatcom County), and Whidbey-Camano Land Trust (Island County).

Impaired Waterbodies

All or portions of the waterbodies listed in Table IV-3 have been listed under Section 303(d) of the Clean Water as impaired waterways. The parameter(s) exceeded are noted for each waterbody. Full extents of the listed waterbodies may be obtained from Washington State Department of Ecology in the "Final 1998 Section 303(d) Listed Waterbodies for Washington State", dated April 4, 2000.

Table IV-3: Section 303(d) Listed Waterbodies in Puget Sound, Hood Canal, Strait of Juan de Fuca and Strait of Georgia Watersheds

Source: Final 1998 Section 303(d) List, Washington State Department of Ecology, April 4, 2000.

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
1	ANDERSON CREEK	Fine Sediment, Temperature
1	ANDERSON DITCH	Dissolved Oxygen, Fecal Coliform
1	BELLINGHAM BAY (INNER) AND WHATCOM WATERWAY	2,4-Dimethylphenol, 2-Methylnaphthalene, Acenaphthene, Anthracene, Arsenic, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Bis(2-ethylhexyl) phthalate, Chrysene, Copper, Dibenz(a,h)anthracene, Dibenzofuran, Fecal Coliform, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Lead, Mercury, Pentachlorophenol, pH, Phenanthrene, Phenol, Pyrene, Sediment Bioassay, Total PCBs, Zinc
1	BELLINGHAM BAY (OUTER)	Fecal Coliform, pH
1	BENDER ROAD DITCH	Dissolved Oxygen, Fecal Coliform
1	BERTRAND CREEK	Ammonia-N, Dissolved Oxygen, Fecal Coliform, Instream Flow
1	BOULDER CREEK	Temperature
1	CANYON (LAKE) CREEK	Temperature
1	CANYON CREEK	Temperature
1	CAVANAUGH CREEK	Temperature
1	CLEARBROOK CREEK	Dissolved Oxygen, Fecal Coliform
1	CORNELL CREEK	Temperature
1	DAKOTA (REBEL) CREEK	Dissolved Oxygen, Fecal Coliform
1	DEER CREEK	Ammonia-N, Dissolved Oxygen, Fecal Coliform, pH
1	DEPOT ROAD DITCH	Dissolved Oxygen, Fecal Coliform
1	DOUBLE DITCH DRAIN	Fecal Coliform
1	DRAYTON HARBOR	Fecal Coliform
1	DUFFNER DITCH	Dissolved Oxygen, Fecal Coliform
1	FISHTRAP CREEK	Fecal Coliform, Instream Flow

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
1	GALLOP CREEK	Temperature
1	HOFF CREEK	Temperature
1	HOWARD CREEK	Fine Sediment, Temperature
1	JOHNSON CREEK	Dissolved Oxygen, Fecal Coliform
1	KAMM (STICKNEY) SLOUGH	Dissolved Oxygen, Fecal Coliform, pH
1	LUMMI BAY & HALE PASSAGE	Fecal Coliform
1	LUMMI RIVER	Fecal Coliform
1	MORMON DITCH	Dissolved Oxygen, Fecal Coliform, pH
1	NOOKSACK RIVER	Fecal Coliform, Fine Sediment
1	NOOKSACK RIVER, M.F.	Temperature
1	NOOKSACK RIVER, S.F.	Fine Sediment, Instream Flow, Temperature
1	PANGBORN CREEK	Dissolved Oxygen, Fecal Coliform, pH
1	RACEHORSE CREEK	Fine Sediment, Temperature
1	ROARING CREEK	Temperature
1	SILVER BEACH CREEK	Fecal Coliform
1	SILVER CREEK	Dissolved Oxygen, Fecal Coliform
1	SQUAW CREEK	Dissolved Oxygen, Fecal Coliform, pH
1	STRAIT OF GEORGIA	Acenaphthene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Cadmium, Chrysene, Dibenz(a,h)anthracene, Dibenzofuran, Fluoranthene, Fluorene, Indeno (1,2,3-cd)pyrene, Phenanthrene, Pyrene, Sediment Bioassay, Total PCBs
1	SUMAS CREEK	Dissolved Oxygen, Fecal Coliform
1	TENNANT CREEK	Dissolved Oxygen, Fecal Coliform
1	UNNAMED CREEK	Dissolved Oxygen, Fecal Coliform
1	UNNAMED CREEK WDF#01.0146	Dissolved Oxygen, Fecal Coliform
1	UNNAMED CREEK WDF#01.0148	Fecal Coliform
1	WHATCOM CREEK	Fecal Coliform, Temperature
1	WHATCOM LAKE	Dissolved Oxygen
2	SAN JUAN CHANNEL	Fecal Coliform
3	BIG LAKE	Total Phosphorus
3	BROWNS SLOUGH	Fecal Coliform
3	CARPENTER CREEK	Fecal Coliform, Temperature
3	COAL CREEK	Temperature
3	CUMBERLAND CREEK	Temperature
3	DAY CREEK	Temperature
3	FISHER CREEK	Temperature
3	FRIDAY CREEK	Fecal Coliform
3	GAGES SLOUGH	Fecal Coliform
3	HANSEN CREEK	Fecal Coliform, Fish Habitat, Temperature
3	INDIAN (BIG) SLOUGH	Dissolved Oxygen, Fecal Coliform, Temperature
3	JOE LEARY SLOUGH	Dissolved Oxygen, Fecal Coliform, Temperature
3	JONES CREEK	Temperature
3	KETCHUM LAKE	Total Phosphorus

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
3	MUD LAKE CREEK	Temperature
3	NONAME SLOUGH	Dissolved Oxygen, Fecal Coliform
3	NOOKACHAMPS CREEK	Fecal Coliform, Temperature
3	NOOKACHAMPS CREEK, E.F.	Temperature
3	OTTER POND CREEK	Temperature
3	PADILLA BAY, FIDALGO BAY, AND GUEMES CHANNEL	PCB-1254
3	PARKER CREEK	Fish Habitat
3	RED CREEK	Temperature
3	SAMISH BAY	Fecal Coliform
3	SKAGIT BAY AND SIMILK BAY	Fecal Coliform
3	SKAGIT RIVER	Fecal Coliform
3	SORENSON CREEK	Fish Habitat
3	TURNER CREEK	Temperature
3	UNNAMED CREEK	Fecal Coliform
3	WILEY SLOUGH	Fecal Coliform
3	WISEMAN CREEK	Temperature
4	FINNEY CREEK	Temperature
4	GRANDY CREEK	Temperature
4	JACKMAN CREEK	Temperature
5	DEER CREEK	Temperature
5	FISH CREEK	Fecal Coliform
5	HARVEY CREEK	Fecal Coliform
5	HIGGINS CREEK	Temperature
5	JIM CREEK	Fecal Coliform
5	JORGENSON SLOUGH (CHURCH CREEK)	Fecal Coliform
5	LITTLE DEER CREEK	Temperature
5	MARTHA LAKE CREEK	Fecal Coliform
5	OLD STILLAGUAMISH RIVER	Fecal Coliform
5	PILCHUCK CREEK	Dissolved Oxygen, Temperature
5	PORT SUSAN	Fecal Coliform
5	PORTAGE CREEK	Dissolved Oxygen, Fecal, Turbidity
5	STILLAGUAMISH RIVER	Ammonia-N, Arsenic, Copper, Dissolved Oxygen, Fecal Coliform, Lead, Nickel, Temperature
5	STILLAGUAMISH RIVER, N.F.	Fecal Coliform, Temperature
5	STILLAGUAMISH RIVER, S.F.	Dissolved Oxygen, Fecal Coliform, pH, Temperature
5	SUNDAY LAKE	Total Nitrogen, Total Phosphorus
5	UNNAMED CREEK WDF#05.0456	Fecal Coliform
6	PENN COVE	Dissolved Oxygen
6	PORT SUSAN	Fecal Coliform
6	SARATOGA PASSAGE	Dissolved Oxygen, pH
6	SKAGIT BAY AND SIMILK BAY	Dissolved Oxygen, Fecal Coliform
7	ALLEN CREEK	Dissolved Oxygen, Fecal Coliform
7	BLACKMANS LAKE	Fecal Coliform, Total Phosphorus
7	EBEY SLOUGH	Dissolved Oxygen, Fecal Coliform, pH, Water Column Bioassay

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
7	FRENCH CREEK	Dissolved Oxygen, Fecal Coliform
7	PILCHUCK RIVER	Fecal Coliform, Temperature
7	PORT GARDNER AND INNER EVERETT HARBOR	2,4-Dimethylphenol, 2-Methylnaphthalene, 2-Methylphenol, 4-Methylphenol, Acenaphthene, Benzo(a)pyrene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Benzyl alcohol, Bis(2-ethylhexyl) phthalate, Chrysene, Di-n-octyl phthalate, Fluoranthene, Fluorene, Mercury, Naphthalene, Pentachlorophenol, Phenanthrene, Phenol, Sediment Bioassay, Total PCBs, Zinc
7	POSSESSION SOUND (NORTH)	2,4-Dimethylphenol, 2-Methylnaphthalene, 2-Methylphenol, 4-Methylphenol, Acenaphthene, Arsenic, Benzoic Acid, Benzyl Alcohol, Bis(2-ethylhexyl) phthalate, Cadmium, Copper, Dibenzofuran, Dissolved Oxygen, Fluorene, Lead, Mercury, Naphthalene, Phenanthrene, Phenol, Sediment Bioassay, Zinc
7	QUILCEDA CREEK	Dissolved Oxygen, Fecal Coliform
7	RAGING RIVER	pH
7	SKYKOMISH RIVER	Copper, Fecal Coliform, Lead, Silver, Temperature
7	SNOHOMISH RIVER	2-Methylnaphthalene, Acenaphthene, Arsenic, Copper, Dibenzofuran, Dissolved Oxygen, Fecal Coliform, Fluorene, Mercury, Naphthalene, Phenanthrene, Temperature
7	SNOQUALMIE RIVER	Temperature
7	SNOQUALMIE RIVER, S.F.	pH, Temperature
7	STEVENS LAKE	Total Phosphorus
7	WALLACE RIVER	Temperature
7	WOOD CREEK (MARSH LANDS)	Dissolved Oxygen
7	WOODS CREEK	Fecal Coliform
8	BEAR-EVANS CREEKS	Fecal Coliform, Mercury
8	BEAVER NO. 1 LAKE	Total Phosphorus
8	BEAVER NO. 2 LAKE	Total Phosphorus
8	CEDAR RIVER	Fecal Coliform
8	COAL CREEK	Fecal Coliform
8	COTTAGE LAKE	Total Phosphorus
8	EDEN (ETON) CREEK	Fecal Coliform
8	FAIRWEATHER BAY CREEK	Fecal Coliform, Temperature
8	FORBES CREEK	Fecal Coliform
8	GREEN LAKE	Total Phosphorus
8	ISSAQUAH CREEK	Fecal Coliform, Temperature
8	JUANITA CREEK	Fecal Coliform
8	KELSEY CREEK	DDT, Dieldrin, Fecal Coliform, Heptachlor Epoxide
8	LAUGHING JACOB'S CREEK	Fecal Coliform

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
8	LEWIS CREEK	Fecal Coliform
8	LITTLE BEAR CREEK	Fecal Coliform
8	LYON CREEK	Fecal Coliform
8	MARTHA LAKE	Total Phosphorus
8	MAY CREEK	Copper, Fecal Coliform, Lead, Temperature, Zinc
8	McALEER CREEK	Fecal Coliform
8	MERCER SLOUGH	Dissolved Oxygen, Fecal Coliform, pH
8	MULLEN SLOUGH	Fecal Coliform
8	NORMA CREEK	Dissolved Oxygen, Fecal Coliform
8	NORTH CREEK	Dissolved Oxygen, Fecal Coliform
8	PINE LAKE CREEK	Fecal Coliform
8	PUGET SOUND (CENTRAL)	2-Methylnaphthalene, Acenaphthene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Chrysene, Dibenz(a,h)anthracene, Dibenzofuran, Fluoranthene, Fluorene, Indeno(1,2,3-cd) pyrene, Mercury, Naphthalene, Phenanthrene, Total PCBs
8	SAMMAMISH LAKE	Fecal Coliform
8	SAMMAMISH RIVER	Dissolved Oxygen, Fecal Coliform, pH, Temperature
8	SCRIBER LAKE	Total Phosphorus
8	SILVER LAKE	Fecal Coliform
8	SWAMP CREEK	Dissolved Oxygen, Fecal Coliform
8	THORNTON CREEK	Fecal Coliform
8	TIBBETTS CREEK	Fecal Coliform
8	UNION LAKE, LAKE WASHINGTON, WASHINGTON SHIP CANAL	Dieldrin, Sediment Bioassay
8	WASHINGTON LAKE	Fecal Coliform, Sediment Bioassay
8	YARROW BAY CREEK	Fecal Coliform
9	COLD SPRINGS CREEK	Fecal Coliform
9	CRISP CREEK	Fecal Coliform
9	DES MOINES CREEK	Fecal Coliform
9	DUWAMISH WATERWAY & RIVER	1,2,4-Trichlorobenzene, 1,4-Dichlorobenzene, 2,4-Dimethylphenol, 2-Methylnaphthalene, 4-Methylphenol, Acenaphthene, Anthracene, Arsenic, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Benzoic acid, Benzyl alcohol, Bis(2-ethylhexyl)phthalate, Butylbenzyl phthalate, Cadmium, Chromium, Chrysene, Copper, Dibenz(a,h)anthracene, Dibenzofuran, Diethyl phthalate, Dimethyl phthalate,
9	DUWAMISH WATERWAY & RIVER	Dissolved Oxygen, Fecal Coliform, Fluoranthene, Fluorene, Hexachlorobenzene,

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
		Indeno(1,2,3-c,d)pyrene, Lead, Mercury, N-nitrosodiphenylamine, Naphthalene, PAHs, PCB-1254, PCB-1260, pH, Phenanthrene, Phenol, Pyrene, Sediment Bioassay, Silver, Total PCBs, Zinc
9	ELLIOTT BAY	1,2,4-Trichlorobenzene, phthalate, Cadmium, Copper, Di-n-butyl phthalate, Dibenzofuran, Diethyl phthalate, Dissolved Oxygen, Fecal Coliform, Fluoranthene, Fluorene, Lead, Mercury, N-nitrosodiphenylamine, Naphthalene, Phenanthrene, Phenol, Silver, Total PCBs, Zinc
10	FIFE DITCH	Ammonia-N, Dissolved Oxygen, Fecal Coliform
10	FOX CREEK	Temperature
10	GREENWATER RIVER	Temperature
10	HYLEBOS CREEK	Fecal Coliform
10	HYLEBOS CREEK, W.F.	Fecal Coliform
10	KINGS CREEK	Temperature
10	MEEKER DITCH	Dissolved Oxygen, Fecal Coliform, pH, Temperature
10	PUYALLUP RIVER	Arsenic, Fecal Coliform, Instream Flow
10	SCATTER CREEK	Temperature
10	SOUTH PRAIRIE CREEK	Fecal Coliform, Temperature
10	SUMMIT LAKE	pH
10	SWAN CREEK	Fecal Coliform
10	THEA FOSS (CITY) WATERWAY	PCB-1254, PCB-1260
10	UNNAMED CREEK	Fecal Coliform
10	VOIGHT CREEK	Temperature
10	WAPATO CREEK	Dissolved Oxygen, Fecal Coliform, Instream Flow
10	WHITE (STUCK) RIVER	Copper, Fecal Coliform, Instream Flow, Mercury, pH, Temperature
10	WILKENSON CREEK	Copper Temperature
11	CATT CREEK	Temperature
11	CLEAR LAKE	Total Phosphorus
11	HARTS LAKE	Total Phosphorus
11	McALLISTER CREEK	Dissolved Oxygen, Fecal Coliform
11	NISQUALLY REACH/DRAYTON PASSAGE	Fecal Coliform
11	NISQUALLY RIVER	Fecal Coliform
11	OHOP CREEK	Fecal Coliform
11	OHOP LAKE	Total Phosphorus
12	AMERICAN LAKE	Total Phosphorus
12	CHAMBERS CREEK	Copper, Fecal Coliform, PCB-1254, PCB-1260, Temperature
12	CLOVER CREEK	Dissolved Oxygen, Fecal Coliform, Temperature
12	SNAKE LAKE	Dissolved Oxygen, Fecal Coliform, Total

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
		Phosphorus
12	SPANAWAY CREEK	Temperature
12	STEILACOOM LAKE	Sediment Bioassay, Total Phosphorus
12	UNNAMED CREEK (tributary to Clover Creek/99th Street)	Fecal Coliform
12	UNNAMED CREEK (tributary to Clover Creek/ Bingham Ave)	Fecal Coliform
12	UNNAMED CREEK (tributary to Clover Creek/Brookdale Rd.)	Fecal Coliform
13	AYER (ELWANGER) CREEK	Dissolved Oxygen, Fecal Coliform, pH
13	BUDD INLET (INNER)	2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluorene, Benzo(b,k)fluoranthenes, Benzo(ghi)perylene, Benzo(k)fluorene, Bis(2-ethylhexyl)phthalate, Butylbenzyl phthalate, Chromium, Chrysene, Copper, Dibenz(a,h)anthracene, Dibenzofuran, Dissolved Oxygen, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Mercury, Naphthalene, PAHs, PCB-1254, pH, Phenanthrene, Pyrene, Sediment Bioassay, Total PCBs, Zinc
13	BUDD INLET (OUTER)	Dissolved Oxygen, pH
13	CAPITOL (NORTH ARM) LAKE	Fecal Coliform, Total Phosphorus
13	DESCHUTES RIVER	Fecal Coliform, Fine Sediment, Instream Flow, Large Woody Debris, pH, Temperature
13	DOBBS CREEK	Fecal Coliform, pH
13	HENDERSON INLET	Dissolved Oxygen, Fecal Coliform
13	HUCKLEBERRY CREEK	Temperature
13	INDIAN CREEK	Fecal Coliform
13	McLANE CREEK	pH
13	MISSION CREEK	Fecal Coliform
13	MOXLIE CREEK	Fecal Coliform
13	NISQUALLYREACH/DRAYTON PASSAGE	Fecal Coliform
13	RIECHEL CREEK	Fecal Coliform
13	SLEEPY (LIBBEY) CREEK	Dissolved Oxygen, Fecal Coliform, pH
13	SQUAXIN, PEALE, & PICKERING PASSAGES	Dissolved Oxygen, pH
13	WARD LAKE	PCB-1260
13	WOODARD CREEK	Dissolved Oxygen, Fecal Coliform, pH
13	WOODLAND CREEK	Dissolved Oxygen, Fecal Coliform, Instream Flow, Temperature
14	BURNS CREEK	Fecal Coliform, pH
14	CAMPBELL CREEK	Fecal Coliform
14	CASE INLET & DANA PASSAGE	Dissolved Oxygen, Fecal Coliform
14	GOLDSBOROUGH CREEK	Fecal Coliform
14	GREAT BEND/LYNCH COVE	Dissolved Oxygen, Fecal Coliform, pH

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
14	HAMMERSLEY INLET	Fecal Coliform
14	HAPPY HALLOW CREEK	Fecal Coliform
14	KENNEDY CREEK	pH
14	OAKLAND BAY	Fecal Coliform
14	PERRY CREEK	pH
14	PIERRE CREEK	Fecal Coliform, pH
14	SCHNEIDER CREEK	pH
14	SHELTON CREEK	Fecal Coliform
14	SHELTON HARBOR (INNER)	Fecal Coliform
14	SKOOKUM CREEK	Fecal Coliform
14	TWANOH FALLS CREEK	pH
14	UNCLE JOHN CREEK	Fecal Coliform
14	UNNAMED CREEK	pH
15	ANNAPOLIS CREEK	Fecal Coliform
15	BARKER CREEK	Fecal Coliform
15	BEAR CREEK	Fecal Coliform
15	BEAVER CREEK	Fecal Coliform
15	BIG BEEF CREEK	Temperature
15	BLACKJACK CREEK	Fecal Coliform
15	BURLEY CREEK	Fecal Coliform
15	CARR INLET	Dissolved Oxygen, Fecal Coliform
15	CASE INLET & DANA PASSAGE	Fecal Coliform, pH
15	CLEAR CREEK	Fecal Coliform
15	DOGFISH CREEK	Fecal Coliform, Turbidity
15	DYES INLET & PORT WASHINGTON NARROWS	3,3'-Dichlorobenzidine, Antimony, Arsenic, Benz(a)anthracene, Benzo(b)fluoranthene, Bis(2-ethylhexyl)Phthalate, Cadmium, Chrysene, Fecal Coliform, Mercury, Pentachlorophenol, Phenol, Sediment Bioassay, Silver
15	EAGLE HARBOR	Arsenic, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Mercury, PAHs, PCB-1254
15	GAMBLE CREEK	Fecal Coliform, Temperature
15	GORST CREEK	Fecal Coliform
15	GREAT BEND/LYNCH COVE	Dissolved Oxygen, Fecal Coliform, pH
15	GROVERS CREEK	Fecal Coliform
15	HENDERSON BAY	Dissolved Oxygen, Fecal Coliform
15	HOOD CANAL (NORTH)	4-Methylphenol, Acenaphthene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Bis(2-ethylhexyl) Phthalate, Chrysene, Copper, Dibenzo(a,h)anthracene, Dibenzofuran, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Lead, Mercury, Pentachlorophenol, Phenanthrene, Pyrene, Total Benzofluoranthenes, Zinc
15	HOOD CANAL (SOUTH)	Dissolved Oxygen

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
15	HUGE CREEK	Fecal Coliform
15	KITSAP LAKE	Fecal Coliform, Total Phosphorus
15	LAGOON CREEK	pH
15	LITTLE MINTER CREEK	Fecal Coliform, pH
15	MARTHA-JOHN CREEK	Fecal Coliform
15	MAYO CREEK	Fecal Coliform, pH, Temperature
15	MILLER LAKE CREEK	Temperature
15	MINTER CREEK	Fecal Coliform
15	NISQUALLY REACH/DRAYTON PASSAGE	Fecal Coliform
15	PICNIC CREEK	Fecal Coliform, pH
15	PORT GAMBLE BAY	Dieldrin, Fecal Coliform
15	PORT ORCHARD, AGATE PASSAGE & RICH PASSAGE	Arsenic
15	PRIVATE CREEK	Fecal Coliform, pH
15	PURDY CREEK	Fecal Coliform
15	QUARTERMASTER HARBOR	Dieldrin, Dissolved Oxygen
15	RAVINE CREEK	Fecal Coliform
15	SHOOFLY CREEK	Fecal Coliform
15	SINCLAIR INLET	1,4-Dichlorobenzene, 2,4-Dimethylphenol, 4-Methylphenol, Aldrin, Arsenic, Benz(a)anthracene, Benzo(ghi)perylene, Benzoic acid, Bis(2-ethylhexyl)phthalate, Butylbenzyl phthalate, Cadmium, Chrysene, Copper, Dieldrin, Fecal Coliform, Fluoranthene, Indeno(1,2,3-cd)pyrene, Lead, Mercury, PCB-1254, PCB-1260, Phenanthrene, Phenol, Sediment Bioassay, Zinc
15	STIMSON CREEK	Fecal Coliform
15	TACOMA NARROWS	Dieldrin
15	UNION RIVER	Fecal Coliform
15	UNNAMED CREEK	Fecal Coliform, pH
15	UNNAMED CREEK (in the Stavis Creek System)	Fish Habitat
15	UNNAMED CREEK (in the Anderson Creek System)	Fish Habitat
15	UNNAMED CREEK (in the Big Beef Creek System)	Fish Habitat
15	UNNAMED CREEK (in the Boyce Creek System)	Fish Habitat
15	UNNAMED CREEK (in the Harding Creek System)	Fish Habitat
15	UNNAMED CREEK (in the Little Anderson Creek System)	Fish Habitat
16	HOOD CANAL (SOUTH)	Fecal Coliform
16	HUNTER CREEK	Fecal Coliform
16	PURDY CREEK	Fecal Coliform
16	SKOKOMISH RIVER	Fecal Coliform

Table IV-3

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
16	SKOKOMISH RIVER, N.F.	Instream Flow
16	TEN ACRE CREEK	Fecal Coliform
16	WEAVER CREEK	Fecal Coliform
17	BIG QUILCENE RIVER	Fish Habitat, Instream Flow
17	CHICKEN COOP CREEK	Fecal Coliform
17	CHIMACUM CREEK	Fecal Coliform, Temperature
17	DABOB BAY & QUILCENE BAY	Fecal Coliform
17	DONOVAN CREEK	Temperature
17	JACKSON CREEK	Fish Habitat
17	JOHNSON CREEK	Fecal Coliform
17	LELAND CREEK	Temperature
17	LITTLE QUILCENE RIVER	Temperature
17	MARPLE CREEK	Fish Habitat
17	RIPLEY CREEK	Temperature
17	SEQUIM BAY	Dissolved Oxygen, pH
17	TARBOO CREEK	Temperature
17	THORNDIKE CREEK	Temperature
18	BAGLEY CREEK	Fecal Coliform
18	BELL CREEK	Fecal Coliform
18	CASSALERY CREEK	Fecal Coliform
18	DRY CREEK	Temperature
18	DUNGENESS RIVER	Instream Flow
18	ELWHA RIVER	PCB-1254, Temperature
18	MATRIOTTI CREEK	Fecal Coliform
18	PORT ANGELES HARBOR	Dissolved Oxygen
19	CLALLAM RIVER	Temperature
19	DEEP CREEK	Fine Sediment, Temperature
19	LITTLE HOKO RIVER	Temperature
19	SEKIU RIVER	Temperature
19	SEKIU RIVER, N.F.	Temperature
19	SEKIU RIVER, S.F.	Temperature

Table IV-4: WRIA 5, 6, 10, 11, 13, 15, 18 & 19 Salmonid Species Limiting Factors by Basin

Source: Washington Conservation Commission (http://www.conserver.org/salmon/index.php3)

WRIA	BASIN	LIMITING FACTOR
5	Stillaguamish Watershed	• 4612.4 mi^2 • Between 1956 & 1965, the Stillaguamish is estimated to have contributed about 21% of the anadromous fish production in Puget Sound. • 50% of land use in forestry • 30% of land use in rural residential • 16% of land use in agriculture • 3% of land use in urban • The floodplain forests of most of the mainstem & riparian forests bordering much of the remaining anadromous streams in the watershed were harvested by early 1900s. By the early 1940s, the entire anadromous channel network, with the exception of a few areas had been logged. • Between 1870 & 1968, about 85% of the Stillaguamish tidal marsh was converted to agriculture. Two-third's of this conversion occurred between 1870 & 1886. By 1968, only 7.8 mi^2 of the original salt marsh existed. • Due to upland sediment impacts, the Stillaguamish delta increased between 1947 & 1974 from 131 mi^2 in 1947 to 168.4 mi^2 in 1974, a 28% change. The newly accreted areas (mostly sand & mudflats) are far less value to salmon than the original salt marsh habitat. • Beaver pond habitat (important to coho production) within the anadromous zone of the watershed has been reduced from 81-96% of historic levels. The total estimated historic area of beaver ponds was between 6.2 – 30.8 mi^2. Current estimates – 1.1 mi^2. • 78% of historic wetlands have been impacted or lost. The watershed historically supported 29, 145 acres of wetlands. The current total wetland area is estimated to be 6,269 acres. • Floodplains ➢ Mainstem Stillaguamish has lost over 31% of its side channel habitat, primarily from the construction of dikes & revetments. ➢ The side channels of the North & South Forks have been decreased by 1/3 of historic levels, primarily due to filling associated with revetments, agriculture, & railroad & road construction. • Riparian Forests of floodplains & uplands have

WRIA	BASIN	LIMITING FACTOR
		resulted in a dramatic decrease in LWD & associated pool habitat. ➢ Only 11% of the watershed's riparian forests are in an "intact" fully functional condition. ➢ 11 of the 27 sub-basins have more than 70% degraded riparian forests. ➢ 8 of the 11 sub-basins have suffered more than 90% riparian degradation. ➢ Riparian zones associated with agriculture & rural residential land use are the most severely degraded. ➢ Only 41% of the riparian forests bordering anadromous streams in the watershed will be fully functioning to provide LWD by the end of the 21st century. ➢ The average & maximum number of pieces of wood per 100 meters in agricultural stream channels is 70% less than what is found in forested & rural residential lands. • Sedimentation – Loss of pool area & LWD is associated with increased sediment supply & peak flows. ➢ The mainstem has the highest average percent pool area (45%) followed by the South Fork (35%) & North Fork (28%). ➢ Landslides associated with human land uses are the primary source of sediment. ➢ A total of 1080 landslides have been inventoried for the period from the 1940s – 1990s. ➢ 75% percent of the inventoried landslides in the watershed result from logging roads (22%) or clearcuts (52%). 98% of the volume of sediment is associated with these two sources. ➢ A total of 851 landslides delivered sediment to stream channels. 40% of the 851 slides delivered sediment directly to fish-bearing waters. 61% of the 851 slides delivering sediment to streams occurred in the North Fork drainage, 36% in the South Fork drainage, & 3% in the mainstem drainage. • Increase in peakflows – more prevalent in the North Fork. ➢ Between 1928 & 1995, 10 of the largest peak flows recorded by the North Fork gage occurred between 1980 & 1995. • Low streamflows are problematic from July – September. ➢ The cumulative effect of groundwater withdrawals & loss of wetlands can also contribute to low flows. ➢ Low flow problem areas - the lower mainstem & estuary, Church Creek, North Fork (from Oso to Whitehorse), Pilchuck Creek, Harvey/Armstrong Creek, Tributary 30. ➢ Low summer flows permit saline waters from Puget Sound to move further upstream in the mainstem

WRIA	BASIN	LIMITING FACTOR
		Stillaguamish than in historic times when summer flows were larger. • Nonpoint source pollution – major cause of water quality problems in the watershed. ➢ Associated with agricultural practices, onsite sewage disposal, development & urban runoff, & forest practices. ➢ .Water temperatures above 21 degrees Celsius (optimum is 12 to 14 degrees Celsius) are frequent in the estuary. • Nearshore & Estuary Habitats – ➢ 22 miles of marine shoreline in watershed. This is less than 1% of total nearshore habitat in Puget Sound. ➢ Generally, the nearshore habitat associated with the Stillaguamish is in relatively good condition when compared to the urbanized nearshore areas of Puget Sound. ➢ Primary threat – residential development. ➢ Stillaguamish estuary is experiencing an invasion of non-native cordgrasses (*Spartina).* Primary areas targeted for control – Kayak Point to Warm Beach (less than 1 acre), Warm Beach (less than 2 acres), Port Susan, Hat's Slough to South Pass (100-150 acres), Leque Island (less than 10 acres), South Pass (less than 10 acres), Stillaguamish River (7 acres 2.5 miles upstream), West Pass & Skagit Bay (over 300 acres) & Davis Slough (5 acres)
5	*Recommendations*	• Protect habitat that still retains a significant portion of their original habitat functions or contain a good potential for re-establishing functions. • Priority sub-basins to protect - Squire Creek, Harvey/Armstrong, Upper South Fork, & Lower Pilchuck.
6	Island County Watershed	• Within the watershed, the vast majority of the salmon habitat has been impacted, at some level, by human activities. • Island County is the second smallest but second fastest growing county in Washington State. • The incorporated Urban Growth Areas of Oak Harbor, Langley & Coupeville total 33.3 mi^2. • Government lands total 111.3 mi^2, including state parks & Whidbey Naval Air Station. • 62% (855.9 mi^2) of Island County's land is zoned for residential land use. • 12% of county land zoned for forest management (115.7 mi^2) & agriculture (48.4 mi^2). • The parcels comprising nearly 80% of the County's shoreline are developed, primarily with platted single-family communities. • From a regional standpoint, Island County's major contribution to salmon productivity is its nearshore

WRIA	BASIN	LIMITING FACTOR
		habitats with numerous estuaries & salt marshes & habitat for spawning herring & other forage species. • 20 estuary/salt marsh sites are presumed to support or identified as having potential to support salmonids. • Six sub-basins are currently known or presumed to support salmonids. Ten more sub-basins have been identified as having potential to provide salmonid habitat. • Low flows are presumed to be a key habitat factor in the watershed but data on streamflows is limited. ➢ The cumulative effect of groundwater withdrawals & loss of wetlands can contribute to low flows. ➢ Based on projected effective impervious area, if the County's zoning designations are actualized, impaired & moderately impaired streamflows may be expected in most of the known & potential fish-bearing sub-basins in the watershed. • Access – Culverts, tide gates, & dikes are the main structures impeding or preventing fish passage. ➢ Only 4 sites, identified as being important to salmon, which do not have access issues. • Flooding & Tidal Flows – much of the habitat damage to the salt marshes & estuaries in the watershed has resulted from the loss of connectivity to Puget Sound tidal waters. ➢ Largest impact to tidal connectivity - agriculture & shoreline residential development. ➢ Drainage districts in early 1900s drained many areas. ➢ Residential developments constructed on natural or augmented sand spits, creating a barrier to saltwater flow. ➢ Deer Lagoon, Crockett Lake, Cultus Bay, Swantown Marsh, Maxwelton Estuary, & Crescent Marsh – all impacted by loss of tidal connectivity. • Riparian conditions – generally, riparian zones in agricultural & urban areas have been the most heavily degraded, & in some areas, are totally gone. • Estuary & Nearshore Habitats – ➢ Shoreline residential homes impacting nearshore through construction of bulkheads, docks, groins, & marinas. ➢ Shoreline residential septic systems impact water quality when the systems experience flooding in relation to naturally fluctuating water levels. ➢ Cordgrass (*Spartina*) invasions eliminate native salt marsh vegetation, displace native plants & animals, raise the elevation of the estuary substrate, & lead to an increase in flooding. ➢ North half of Camono Island, Davis Slough, West Pass, Livingston Bay & Triangle Cove are primary targets for *Spartina* control. ➢ Current control activities in Cultus Bay, Deer Lagoon, &

WRIA	BASIN	LIMITING FACTOR
		Lake Hancock. • Water Quality – high water temperature & low dissolved oxygen a concern, but data is limited. •
6	*Recommendations*	• Protect stream & coastal shoreline areas that still retain a significant portion of original habitat functions or possess a high potential for restoration. ➢ Lake Hancock – coastal intertidal environment that still resembles a native ecosystem. Managed as a protected area by Whidbey NAS & The Nature Conservancy. • Protect small, coastal wetlands & freshwaters streams on the east shoreline of Whidbey Island including Grasser's Lagoon, Harrington Lagoon, & Race Lagoon. • Protect & restore nearshore habitat at Cultus Bay, Triangle Cove, Deer Lagoon, Swantown Marsh, Maxwelton Estuary, & Crockett Lake. • Remove fish passage barriers & protect & restore freshwater stream systems & riparian corridors in Glendale, Cultus, North Bluff, Chapman, & Deer Creeks.
10	Puyallup Watershed	• Dramatic loss of estuarine, riverine & wetland habitat processes & their associated functions. ➢ 98% of historical intertidal & subtidal habitat lost in Commencement Bay. ➢ Existing intertidal & subtidal habitat separated and/or chemically contaminated. ➢ The dredging & filing of the estuary, started in the late 1800's, was largely completed by 1930. • The White River was diverted into the Puyallup River Basin in 1906 – almost doubling the flows in the lower Puyallup River. • Extensive levee system has removed natural sinuosity of the rivers & spawning & rearing habitats. ➢ Extensive levee system, dikes & revetments constructed in early 1900's & still maintained. ➢ Puyallup River contained with a revetment & levee system for the lower 26 miles. ➢ White River contained with a revetment & levee system for lower 8 miles. ➢ Carbon Rivers contained within a revetment & levee system for lower 5 miles. • Fish passage barriers ➢ 2 hyrdoelectric dams constructed in the early 1900s on the White River are impassable to salmonids. ➢ Numerous impassable barriers present on smaller

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		tributary streams in the watershed. • Land use practices eliminated opportunities for LWD & SWD recruitment & heavily impacted riparian buffers.
10	*Recommendations*	• Methods for mitigating biological & hydrologic functions in the surface water systems have been ineffective. • Cost associated preserving the remaining functioning habitats & attempting to restore portions of lost habitats will be substantial. • Biological functions historically present in the Puyallup River basin cannot be fully restored. • Fundamental changes in land use will be necessary to restore self-sustaining populations of salmonids in the watershed. • While the Puyallup River basin is faced with many critical issues, Technical Advisory Group believes it is still capable of naturally producing self-sustaining runs of salmonids.
11	Nisqually Watershed	• 54% loss in intertidal emergent marsh habitats in watershed. • The Nisqually River estuary lost approximately 30% of historical intertidal & subtidal habitat. ➢ The diking of the estuary started in 1904 & was largely completed in the late 1920's. Dikes largely in place & maintained today. • Mainstem Nisqually River constrained by a revetment & levee system in the lower 5.2 river miles -) inhibiting lateral channel migration & eliminating spawning & rearing habitats. ➢ Remnant flood control dikes in areas near McKenna ➢ Maintained dikes that protect the Yelm Diversion Canal between RM 21.8 to 26.4. • Off-channel rearing habitats - reduced in the mainstem Nisqually River between 1965-1995. ➢ Off-channel rearing habitats virtually absent between RM 10 – 25 of mainstem Nisqually River. • 2 Hydroelectric projects that don't provide naturalized flow regime to the mainstem Nisqually River. ➢ Yelm Hydroelectric Project - built 1929 with diversion dam at RM 26.2 with water reentering the mainstem Nisqually River via a canal at RM 12.7. Extensive renovations after 1968 - currently meets all fish passage & protection standards. ➢ LaGrande Hydroelectric Project – built 1910 & renovated 1942. Minimum instream flows not established for the Nisqually River until 1978. • Commercial timber activities - increased sediment loads, reduced LWD input & recruitment potential, & altered precipitation run-off patterns.

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		• Agricultural activities – converted pristine valley bottom lands & wetlands. • Rural residential/hobby farms - reduced natural biological processes necessary for the natural production of salmonids in the Nisqually River Basin.
11	*Recommendations*	• Much of the historical estuary is in public ownership & available for return to historic habitats. • Portions of the mainstem Nisqually River corridor in good condition & preservation is the preferred alternative. • Cost associated with preserving the remaining functioning habitats & attempting to restore portions of lost habitats will be substantial. • Many of the biological functions historically present in the Nisqually River Basin can be partially of fully restored. • Restoration will require fundamental changes in land use to restore self-sustaining populations of salmonids in this basin. • Technical Advisory Group believes Nisqually watershed is still capable of self-sustaining runs of naturally produced salmonids.
13	Deschutes Watershed	• Natural stream ecological processes significantly altered due to adjacent land management practices & direct actions within the stream corridor. • Fine sediment (<0.85 mm) levels in the stream gravels regularly exceed the <12% level identified as representing suitable spawning habitat. • Lack of adequate LWD in streams, particularly larger key pieces that are critical to developing pools, log jams, & other habitat components important to salmonids. • Lack of adequate pool frequency & large, deep pools important to rearing juvenile salmonids & adult salmonids on their upstream migration. • Naturally high rates of channel erosion in this geologically young basin, but further exacerbated rate of steambank erosion & substrate instability due to loss of streambank & riparian integrity, & alteration of natural hydrology. • Loss of riparian function due to removal/alteration of natural riparian vegetation – affecting water quality, lateral erosion, streambank stability, instream habitat conditions, etc. • Presence of a significant number of fish passage barriers (culverts, screens, dams, etc.) precluding access to juvenile & adult salmonids. • Significant alterations to the natural stream hydrology in streams associated with heavily developed uplands, & threat of similar impacts to streams experiencing current & future development growth. • Estuarine/marine function significantly impacted by physical alteration of the natural estuary, poor water

WRIA	BASIN	LIMITING FACTOR
		quality in the estuary, & significant alteration of nearshore ecological function due to shoreline armoring.
13	*Recommendations*	• Revision, implementation, & enforcement of land use ordinances that provide protection for natural ecological processes in the marine, instream, & riparian corridors. • Measures to maintain effective impervious surfaces to levels, & in a manner, that will maintain natural hydrology, protection of marine, instream, & riparian habitat that is currently functioning, particularly key habitat areas. • Restoration of natural marine, instream, & riparian ecological processes where they have been impaired. • Status of chinook in Woodland, Percival/Black Lake Ditch, & McLane creeks should be reviewed to determine whether these are the result of self perpetuating spawners, or whether chinook returns are strictly the result of Deschutes River hatchery strays.
15	East Kitsap Watershed	• 125 separate streams entering saltwater that are known to support salmonids, with an estimated 215 miles of known anadromous salmonid utilization. • Production potential of streams is very high due to the low-gradient nature of the streams, the lack of natural anadromous fish passage barriers, & the extensive wetland complexes in many of the drainages. • 320 miles of marine shoreline & nearshore habitat. • Freshwater & marine nearshore salmonid habitat conditions generally better in northern & southern portions of watershed than in the more heavily developed central portion. • Loss of freshwater riparian function due to removal/alteration of natural riparian vegetation – affecting water quality, lateral erosion, bank stability, instream habitat conditions, & LWD recruitment. • Fish passage barrier (culverts, screens, dams) precluding access to juvenile & adult salmonids. • Lack of adequate LWD in streams, particularly larger key pieces that are critical to developing pools, log jams, & other habitat diversity important to salmonids. • Lack of adequate pool frequency, or large deep pools that are important to rearing juvenile salmonids & adult salmonids on their upstream migration. • Loss of natural floodplain processes, due to dredging, bank armoring, & channelization, including the loss of functional off-channel habitat. • Insufficient erosion controls during construction operations, & ineffective stormwater controls (water quality & quantity). • Loss/impairment of instream flows during dry periods due to degradation & loss of headwater & floodplain wetlands, that store water during wet periods & meter flows to the

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		streams during dry periods. • Substrate sediment stability & composition affected in a number of freshwater drainages due to lack of effective stormwater runoff controls. • Natural stream ecological processes significantly altered due to adjacent land management practices & direct actions within the stream corridor. • Substantial increases in peak flow frequency & magnitude due to channelization & increased stormwater runoff from lands converted to non-forest status; many less developed streams facing similar threats from growth & further conversion of forestland to non-forest status. • Salmonid habitat quality & quantity adversely impacted by the cumulative effects of poor agricultural practices & timber harvest that exceeds sustainable levels. • Fine sediment (<.85 mm) levels in the gravels of several streams are identified as likely being high enough to adversely affect spawning success & benthic invertebrate production. • Estuarine/marine nearshore function substantially impacted by physical alteration of natural estuaries, by alteration of nearshore ecological function due to extensive shoreline armoring, by loss of shoreline LWD, by loss of shoreline riparian shade, & by poor water/sediment quality.
15	*Recommendations*	• Improved resource stewardship by landowners; regulations alone will not be effective without landowner commitment to resource protection & stewardship. • Revision, implementation, & enforcement of land use ordinances that provide protection for natural ecological processes in the marine, instream, & riparian corridors. • Measures to limit impervious surfaces to levels, & in a manner, that will maintain natural hydrology. • Protection of marine, instream, & riparian habitat that is currently functioning, particularly key habitat areas. • Restoration of natural marine, instream, & riparian ecological processes where they have been impaired.
18	Elwha-Dungeness Watershed	• Watershed includes 2 large river systems (Dungeness & Elwha rivers); 1 medium sized river system (Morse Creek); & 14 smaller independent drainages to salt water. • Natural stream ecological processes significantly altered due to adjacent land management practices & direct actions within the stream corridor. ➢ Dungeness River salmonid habitat in the anadromous accessible zone heavily impacted by land use practices dating back to the mid-1800s. ➢ Land use impacts from logging in headwater tributaries, agricultural & development in the lower watershed, alteration of natural channel characteristics with heavy

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		equipment, & floodplain constriction due to dikes, levies, & transportation corridors. ➢ Morse Creek, a significant producer of anadromous salmonids, signifcantly altered channel by channelization, forest practices, & development. ➢ Habitat in upper portions of McDonald, Siebert, Bagley, & Lees creeks adversely affected by recent forest practices, agricultural practices, & rural development. ➢ Ennis, Peabody, Valley, Tumwater & Dry Creeks highly modified to accommodate urban & commercial development in Port Angeles. • Substrate sediment transport processes altered to the extent that has resulted in stream morphology changes, either due to excess sediment contribution from land use practices, or preclusion of sediment transport due to dams. • Fine sediment (<.85 mm) levels in the gravels of several streams are identified as likely being high enough to adversely affect spawning success & benthic invertebrate production. • Lack of adequate LWD in streams, particularly larger key pieces that are critical to developing pools, log jams, & other habitat diversity important to salmonids. • Lack of adequate pool frequency, or large deep pools that are important to rearing juvenile salmonids & adult salmonids on their upstream migration. • Loss of natural floodplain processes, due to confinement of channels by dikes, levees, bank armoring, & channelization, including the loss of functional off-channel habitat. ➢ Floodplain & channel downstream of the Elwha Dam altered by construction of dikes, water diversion pipelines, & development. ➢ Morse Creek floodplain function severely altered by floodplain constrictions resulting from diking, development encroachment, & transportation corridors. • Loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, lateral erosion, streambank stability, & instream habitat conditions. ➢ Dungeness tributaries & independent drainages heavily influenced by a history of channelization, riparian vegetation removal, & open access to livestock. • Numerous fish passage barriers (culverts, screens, dams) precluding access to juvenile & adult salmonids. ➢ Excellent habitat conditions in most of the Elwha River – located in Olympic National Park (ONP). Anadromous salmonids precluded from 70 miles of mainstem habitat & all tributary habitat since Elwha Dam built in 1910, &

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		Glines Canyon Dam built upstream. • Significant increase in peak flow frequency & magnitude due to channelization, routing of stormwater through the irrigation delivery system, & increased stormwater runoff from lands converted to non-forest status. Many less developed streams face similar threats from further development & growth. • Alteration & reduction of the normal streamflow regime due to irrigation & other water withdrawals. ➢ Dungeness River valley has the most intensively developed irrigation use of any river system in western Washington. • Estuarine/marine function significantly impacted by physical alteration of natural estuaries, significant alteration of nearshore ecological function due to shoreline armoring, & poor water quality in Port Angeles harbor. ➢ Elwha estuary & marine nearshore area significantly altered by the loss of sediment transport from the Elwha River & marine feeder bluffs, & diking that precludes flow through historic distributaries. ➢ Dungeness estuary completely modified from historic condition by extensive diking & conversion of historic estuary to agriculture & development lots. ➢ Dungeness Bay marine nearshore habitat affected by alteration of sediment transport from the Dungeness River, by shoreline armoring, & by loss of eelgrass habitat. ➢ Historic estuary conditions, thought to be in large part responsible for Morse Creek's productivity, have been basically eliminated by development. ➢ Marine nearshore habitat at the mouth of Morse Creek altered by historic railroad construction & armoring within the intertidal area, eliminating the shallow nearshore habitat to the west of Morse Creek. ➢ Marine shoreline is armored from the mouth of Morse Creek, west through Port Angeles to the end of Ediz Hook - effectively eliminates most, if not all, natural nearshore habitat function.
18	*Recommendations*	• Priority restoration based on salmonid productivity potential: ➢ Highest – Dungeness River (including tributaries), Elwha River, Morse Creek ➢ Moderate – Ennis, Siebert, Gierin, & Meadowbrook, Bell, Cassalery, & McDonald creeks ➢ Lower –Cooper, Bagley, Lees, Valley, & Tumwater creeks ➢ Little potential – Peabody Creek, Dry, & White (tributary to Ennis) creeks

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		• Restoration of the marine nearshore is a high priority, based on benefits to all salmonid stocks including stocks originating outside the watershed. • Revision, implementation, & enforcement of land use ordinances that provide protection for natural ecological processes in the marine, instream, & riparian corridors, including measures to maintain impervious surfaces to levels, & in a manner, that will maintain natural hydrology, • Protection of marine, instream, & riparian habitat that is currently functioning, particularly key habitat areas • Restoration of natural marine, instream, & riparian ecological processes where they have been impaired.
19	Lyre-Hoko Watershed	• Excessive sedimentation & Lack of LWD throughout watershed. • Lack of LWD major problem for Agency, Colville, Field, Jansen, Jim, Joe, Murdock, Sail & Whiskey Creeks. • Conversion of riparian zone to alder or open areas major problem in Bullman, Colville, Field, Jansen, Jim, Joe, Murdock, Sail & Whiskey Creeks. • Excessive sedimentation from roads in Bullman, Field, Jansen, Jim, Joe, Rasmussen, Snow & WhiskeyCreeks. • Human caused fish passage barriers in Agency, Colville, Field, Jim, Joe, Sail & Village Creeks. • High water temperatures in Agency & Rasmussen Creeks. • Estuarine impacts near Whiskey & Jim Creeks. • Nearshore impacts from sediments from Highway 112 impacting eelgrass habitat.

Table IV-4

WRIA	BASIN	LIMITING FACTOR
19	Hoko River Subwatershed	• Excess sedimentation is a major limiting factor for this watershed, with sources from roads & clearcuts. ➢ Channel instability due to excessive sedimentation. ➢ Lack of suitable spawning gravels due to sedimentation. • Lack of LWD & potential contributing LWD in the futre. ➢ Many riparian areas dominated by hardwoods. ➢ Change in age & type of surrounding forests contributes to increased frequency & severity of peak flows. • Riparian roads, dikes, channelization & an old railroad grade along the Little Hoko River have encroached on the floodplain. ➢ Encroachment results in constrained channels, reduced side channel habitat, reduced riparian vegetation, & associated reduction in LWD recruitment. ➢ Riparian roads add to excess sedimentation. • Low flows in the summer & early autumn. ➢ contributes to high water temperatures ➢ limits spawning distribution of fall Chinook to less stable areas of the mainstem. ➢ Natural low flows worsened by water withdrawals. • Numerous culverts are impairing fish passage. • Estuarine habitat altered by sediment deposition in recent history.
19	*Seiku River Subwatershed*	• Excessive sedimentation problems due to high road densities & mass wasting sites. ➢ Led to debris flows that have incised the mainstem channel & removed LWD • Impacts associated with the “Mainline” & other riparian roads ➢ increase in channel instability (constrictions) ➢ increased sediment ➢ loss of riparian vegetation ➢ loss of off-channel habitat. • Lack of LWD & deep pools • Extensive riparian areas dominated by hardwoods • Timber harvest management activities significantly reduced the age of the surrounding forests. • High summer water temperatures in mainstem & South Fork due to human alterations of riparian area. • Timber harvest management activities contributed to increases in water turbidity. • Human caused fish passage barriers.
19	*Pysht River Subwatershed*	• Sedimentation from roads & mass wasting sites leading to channel instability, especially in the mainstem. • Lack of LWD resulting in increased channel instability, peak flow impacts, decreased pool habitat formation, & spawning gravel storage.

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		• Hardwood dominate riparian habitat leading to lack of future LWD & high water temperatures. • Highway 112 restricting floodplain, contributing to sediment problems, reducing riparian vegetation, & increasing channel instability. • Channelization in the lower 1 ½ miles of mainstem • Excessive sediment delivery to the Estuary. ➢ Eelgrass habitat may have been lost due to sedimentation • Human caused fish passage barriers.
19	*Clallam River Subwatershed*	• Excessive sedimentation • Lack of LWD • Open or hardwood riparian area • Summer high water temperatures associated with altered riparian areas. • Gravel bar scalping & riparian roads impacting the floodplain. • Loss of salt marsh habitat in Estuary. • Intermittent blockage near the mouth caused by gravel. • Human caused fish passage barriers.
19	*Deep Creek Subwatershed*	• Excessive sedimentation • Debris flows resulted in excessive channel incision & instability. ➢ Channel incisions results in lack of off-channel habitat ➢ Channel incisions & lack of LWD worsens water velocities. • Lack of LWD • Open or Hardwood dominated riparian areas resulting in future lack of LWD & high water temperatures. • Estuary impacted by excessive sedimentation. • Timber management resulted in forest vegetation dominated by young conifers. ➢ lack of older trees increase frequency & severity of peak flow events • Human caused fish passage barriers – low priority restoration activity.
19	*Twin Rivers Subwatershed*	• Lack of LWD in lower reaches • Sedimentation associated with roads. • Fish passage barriers in East Fork of the East Twin River. • Impacts to the estuary exist near the mouth of both Twin Rivers.
19	*Lyre River Subwatershed*	• Fine sediment impacts from Boundary & Susie Creeks. ➢ Resulting in degraded spawning habitat & increased water turbidity. • Alder-dominated riparian area in Nelson Creek • Lack of LWD in Nelson Creek, Susie Creek, & lower mainstem. ➢ “Stream cleaning” or removal of LWD contributed to lack

Table IV-4

WRIA	BASIN	LIMITING FACTOR
		of LWD. • Channelization in the lower mile of the mainstem • Fish passage barriers lessor impact in watershed.
19	*Salt Creek Subwatershed*	• Impacts associated with land conversion to accommodate development. ➢ Lack of LWD ➢ Loss of holding pools ➢ Increased demand for water, unauthorized water withdrawals. ➢ Excessive sedimentation. • Loss of salt marshes in the estuary due to roads. • Fish passage blockages lessor impact in watershed. • Minor problem – floodplain impacts due to riparian roads.
19	*Recommendations*	• Enforce current environmental regulations, such as the Hydraulic Code, Forest Practices Act, Shoreline regulations, Critical Area Ordinances, & Growth Management Act. • Revise the Growth Management Act to protect salmon habitat. • Protect the channel migration zone (floodplain) habitat. Floodplain development leads to a loss of riparian forest & loss of future LWD. It also increases sedimentation, channel instability, & water quality problems. • Protect conifer riparian areas. • Convert open & hardwood riparian areas to conifer. • Increase off-channel habitat. • Increase instream LWD, preferably with attached rootwads. • Stop the removal of instream wood. • Prevent the increase of water withdrawals. These can have a large impact on salmon because of the naturally low flow conditions in the summer & early autumn. • Set up a State/Tribal/County committee to identify & purchase critical salmon habitat for conservation & to address problem areas.

Region 3 – Lower Columbia River Watersheds

Geographic Boundaries

The Lower Columbia River Watersheds include:

- Lower Columbia – Sandy watershed [HUC[69] 17080001 and WRIA[70] 28]

[69] Hydrologic Unit Code (HUC)

- Lewis watershed [HUC 17080002 and WRIA 27]
- Lower Columbia – Clatskanie watershed [HUC 17080003, and WRIA 25]
- Upper Cowlitz watershed [HUC 17080004 and WRIA 26]
- Lower Cowlitz watershed [HUC 17080005 and WRIA 26]
- Lower Columbia watershed [HUC1708006, and WRIA 24 and 25]

The watersheds stretch into Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum Counties.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species descriptions and the factors to their decline, see Appendix A.

Birds:

- Bald eagle *(Haliaeetus leucocephalus)* — Threatened
- Brown pelican *(Pelecanus occidentalis)* — Endangered
  [Pacific County – Baker Bay only]
- Marbled murrelet *(Brachyramphus marmoratus)* — Threatened
  Designated critical habitat
  [Cowlitz, Lewis, Pacific, and Wahkiakum Counties]
- Northern spotted owl *(Strix occidentalis caurina)* — Threatened
  Designated critical habitat

- Western snowy plover *(Charadrius alexandrinus nivosus)* — Threatened
  Designated critical habitat
  [Pacific County only]

Fish:

- Columbia River chum (*Oncorhynchus keta)* — Threatened
  Designated critical habitat
- Columbia River bull trout *(Salvelinus confluentus)* — Threatened
  [Clark, Lewis and Skamania Counties]
- Lower Columbia River chinook (*Oncorhynchus tshawytscha)* — Threatened
  Designated critical habitat
- Lower Columbia River steelhead *(Oncorhynchus mykiss)* — Threatened
  Designated critical habitat
- Middle Columbia River steelhead *(Oncorhynchus mykiss)* — Threatened
- Snake River fall chinook (*Oncorhynchus tshawytscha)* — Threatened
  Designated critical habitat
  [Columbia River mainstem only]

[70] Water Resource Inventory Area (WRIA)

- Snake River spring/summer chinook (*Oncorhynchus tshawytscha)* — Threatened
  Designated critical habitat
  [Columbia River mainstem only]
- Snake River sockeye (*Oncorhynchus nerka)* — Endangered
  Designated critical habitat
  [Columbia River mainstem only]
- Snake River steelhead *(Oncorhynchus mykiss)* — Threatened
  Designated critical habitat
  [Columbia River mainstem only]
- SW Washington/Columbia River cutthroat trout (*Oncorhynchus clarki clarki*) — Threatened (Proposed)
- Upper Columbia River spring chinook (*Oncorhynchus tshawytscha)* — Endangered
  Designated critical habitat
  [Columbia River mainstem only]
- Upper Columbia River steelhead *(Oncorhynchus mykiss)* — Endangered
  Designated critical habitat
  [Columbia River mainstem only]
- Upper Willamette River chinook (*Oncorhynchus tshawytscha)* — Threatened
  Designated critical habitat
  [Clark, Cowlitz, Pacific and Wahkiakum Counties]
- Upper Willamette River steelhead *(Oncorhynchus mykiss)* — Threatened
  Designated critical habitat
  [Clark, Cowlitz, Pacific and Wahkiakum Counties]

Mammals:

- Canada lynx (*Lynx canadensis*) — Threatened
  [Lewis and Skamania Counties]
- Gray wolf *(Canis lupus)* — Endangered
  [Lewis and Skamania Counties]
- Grizzly bear *(Ursus arctos horribilis)* — Threatened
  [Lewis County Only]
- Columbian white-tailed deer *(Odocoileus virginianus leucurus)* — Endangered
  [Wahkiakum County Only]

Marine Mammals:

- Steller Sea Lion (*Eumetopias jubatus)* — Threatened
  [Columbia River mainstem up to the mouth of the Cowlitz River only]

Plants:

- Kincaid's lupine (*Lupinus sulphureus kincaidii*) — Threatened
  [Lewis County only]
- Nelson's checker-mallow (*Sidalcea nelsoniana)* — Threatened
  [Cowlitz and Lewis Counties]
- Water Howellia (*Howellia aquatilis)* — Threatened

[Clark County only]

- Bradshaw's desert parsley (*Lomatium bradshawii)* Endangered
  [Clark County only]

Land Use Activities

Timber Harvest

The majority of the watersheds have experienced some levels of timber harvesting with most of the timber production focused in Wahkiakum County, the eastern portions Lewis, Cowlitz, and Clark Counties, and Skamania County.

As shown in Table IV-5, many of the waterbodies exceed state standards for temperature and dissolved oxygen. Waterbody impairments often associated with areas where the timber has been overharvested. Table IV-6 identifies limiting factors of excessive fine sediments, lack of large woody debris in streams and in large woody debris recruitment areas, and elevated summer water temperatures. These factors are associated with high forest road densities, removal of riparian habitat, and road construction in riparian areas.

Agricultural Production

Significant agricultural production occurs through out the Lower Columbia River watershed. Conversion of habitat to agricultural lands has resulted in loss of riparian habitat, unstable stream banks with poor cattle exclusion devices, excessive chemical levels in the water associated with pesticides and herbicides, high water temperatures, low dissolved oxygen levels and high levels of fecal coliform. Many streams exceed appropriate width/depth ratios, resulting in high temperatures, sheet flow at high waters, and inadequate velocity levels at low flows.[71] As shown in Table IV-6, several waterbodies have issues with fish passage either due to road crossing or small dams constructed for irrigation of agricultural lands.

[71] Dyrland, R., pers. Comm. 11/20/2000.

Urban Development

Primary impacts associated with urban development in the Lower Columbia River Watersheds are the existence of several hydropower projects including the Bonneville Dam on the mainstem Columbia River. The series of dams along the Columbia River have blocked an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia, replenishing the shorelines along the Washington and Oregon Coasts.[72]

Associated industrial and harbor development have been significant with the Lower Columbia River watersheds, mainly along the mainstem Columbia River. One hundred miles of river channel within the mainstem Columbia River, it's estuary – Baker Bay, and Oregon's Willamette River have been dredged as a navigation channel by the Corps since 1878. Originally dredged to a depth of 20 feet minimum in 1878, the federal navigation channel of the lower Columbia River is now maintained at a depth of 40 feet and a width of 600 feet. The average amount dredged each year is 5.5 million cubic yards of material.[73] The lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland and Vancouver. These ports primarily focus on the transport of timber and agricultural commodities. As shown in Table IV-5, there are several chemical exceedances in Lower Columbia River watersheds in the vicinity of the ports that are associated with industrial activities – such as arsenic, and PAHs.

Lower Columbia River watersheds have also been significantly altered by mining activities both in the past and ongoing. Many streams and rivers have excessive sediment levels and unstable riparian areas due to in-stream mining or upland mining with poor sediment and erosion control measures (See Table IV-6).

The most extensive urban development in the Lower Columbia River watersheds occurs in the Vancouver/Camas areas and the Centralia/Chehalis areas. Outside of these

[72] Corps (1999)
[73] Corps (1999)

major urban areas, the majority of residential development is on septic systems. Common water contaminants associated with urban development and residential septic systems include excessive water temperatures, lowered dissolved oxygen levels, fecal coliform, and chemicals associated with pesticides and urban runoff. Excessive sediment levels have been aggravated by additional sediment loading associated with the explosion of Mount St. Helens in 1980.

Protected areas

The following federally protected areas occur in the Lower Columbia River Watersheds: Franz Lake National Wildlife Refuge (493 acres), Judy Bulter Hansen National Wildlife Refuge (4,757 acres), Lewis and Clark National Wildlife Refuge, Pierce National Wildlife Refuge (329 acres), Ridgefield National Wildlife Refuge (4,627 acres), Steigerwald Lake National Wildlife Refuge (627 acres), Goat Rocks Wilderness (105,023 acres)[74], Mount Rainer National Park, Mount Saint Helens National Volcanic Monument, and the Gifford Pinchot National Forest (1.3 million acres)[75].

Washington State protected Natural Area Preserves (NAP) occurring in the Lower Columbia River Watersheds includes the Columbia Falls (Skamania County – 514 acres). The following Washington State protected Natural Resource Conservation Areas (NRCAs) occur in the Lower Columbia River Watersheds: Merril Lake (Cowlitz County – 114 acres) and Table Mountain/Greenleaf Peak (Skamania County – 2,800 acres).

The following areas are designated Wildlife Areas protected by Washington State Department of Fish and Wildlife: Cowlitz Wildlife Area (Lewis County – 13,940 acres), St. Helens Wildlife Area (Cowlitz & Skamania Counties – 2,500 acres), and Shillapoo and Vancouver Lake Wildlife Area (Clark County – 1,550 acres).

[74] A portion of Goat Rocks Wilderness is located in Region 4
[75] A portion of the Gifford Pinchot National Forest is located in Region 4.

Private protected lands in Lower Columbia Watersheds include: The Nature Conservancy – Robert W. Little (Puget Island) Preserve (Wahkiakum County – 30 acres) and Grays Bay Preserve (Wahkiakum County – 100 acres); and the Columbia Land Trust.

Impaired Waterbodies

All or portions of the waterbodies listed in Table IV-5 have been listed under Section 303(d) of the Clean Water as impaired waterways. The parameter(s) exceeded are noted for each waterbody. Full extents of the listed waterbodies may be obtained from Washington State Department of Ecology in the "Final 1998 Section 303(d) Listed Waterbodies for Washington State", dated April 4, 2000.

Table IV-5: Section 303(d) Listed Waterbodies in Lower Columbia River Watersheds

Source: Final 1998 Section 303(d) List, Washington State Department of Ecology, April 4, 2000.

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
24	COLUMBIA RIVER (Pacific County)	PCB-1254, Total Dissolved Gas
25	COLUMBIA RIVER (Wahkiakum County)	4,4'-DDE, Arsenic, Bis(2-ethylhexyl) Phthalate, Dieldrin, Dissolved Oxygen, Fecal Coliform, PCB –1248, PCB-1254, PCB-1260, Temperature, Total Dissolved Gas
25	ELOCHOMAN RIVER	**Temperature**
25	GERMANY CREEK	Temperature
25	GRAYS RIVER, W.F.	Temperature
25	LONGVIEW DITCHES	Dissolved Oxygen, Fecal Coliform, Lead, Turbidity
25	SACAJAWEA LAKE	4,4'-DDE, Chlordane, Dieldrin, PCB –1254, PCB-1260
26	BAIRD CREEK	Temperature
26	CISPUS RIVER	Temperature
26	CISPUS RIVER, N.F.	Temperature
26	COLUMBIA RIVER	Bis(2-ethylhexyl) Phthalate
26	COWEEMAN RIVER	Temperature
26	COWLITZ RIVER	Arsenic
26	EAST CANYON CREEK	Temperature
26	GOBLE CREEK	Temperature
26	GREEN RIVER	Temperature
26	HERRINGTON CREEK	Temperature
26	IRON CREEK	Temperature
26	MULHOLLAND CREEK	Temperature
26	SILVER CREEK	Temperature
26	WILLAME CREEK	Temperature
27	COLUMBIA RIVER (Clark & Cowlitz Counties)	4,4'-DDE, Arsenic, Bis(2-ethylhexyl) Phthalate, Dieldrin, PCB-1254, Temperature, Total Dissolved Gas
27	HATCHERY (FALLERT) CREEK	Temperature
27	KALAMA RIVER	Temperature
27	LEWIS RIVER, E.F.	Fecal Coliform, Temperature
27	LOCKWOOD CREEK	Fecal Coliform
27	McCORMICK CREEK	Fecal Coliform, Temperature
27	ROCK CREEK (NORTH)	Fecal Coliform
27	ROCK CREEK (SOUTH)	Fecal Coliform
27	YACOLT CREEK	Fecal Coliform
28	BURNT BRIDGE CREEK	Dissolved Oxygen, Fecal Coliform, pH, Temperature
28	CHINA DITCH	Dissolved Oxygen, Temperature
28	CHINA LATERAL	Dissolved Oxygen, Temperature
28	COLUMBIA RIVER (Skamania County)	Arsenic, Fecal Coliform, Sediment Bioassay, Temperature, Total Dissolved Gas
28	COUGAR CANYON CREEK	Dissolved Oxygen

Table IV-5

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
28	COWPIE CREEK	Dissolved Oxygen
28	CURTIN CREEK	Fecal Coliform
28	DWYER CREEK	Dissolved Oxygen, pH
28	FIFTH PLAIN CREEK	Dissolved Oxygen, Fecal Coliform, pH, Temperature
28	GIBBONS CREEK	Fecal Coliform
28	LACAMAS CREEK	Dissolved Oxygen, Fecal Coliform, pH, Temperature
28	LAKE RIVER	Fecal Coliform, Sediment Bioassay, Temperature
28	MATNEY CREEK	Dissolved Oxygen, pH, Temperature
28	MILL CREEK	Fecal Coliform
28	MILL DITCH	Dissolved Oxygen, pH, Temperature
28	SALMON CREEK	Fecal Coliform, Temperature, Turbidity
28	SHANGHAI CREEK	Dissolved Oxygen, pH, Temperature
28	WEAVER (WOODIN) CREEK	Fecal Coliform

Table IV-6: WRIA 26 & 27 Salmonid Species Limiting Factors by Basin

Source: Washington Conservation Commission (http://www.conserver.org/salmon/index.php3)

WRIA	BASIN	LIMITING FACTOR
26	Entire WRIA	• LWD abundance is below habitat standards. • Poor riparian conditions. • Most of the historic off-channel & floodplain habitat is disconnected from the river by diking, hardening of the channels, & 1980 Mount St. Helens eruption. • Complete fish passage barriers at Mayfield, Mossyrock & Cowlitz Falls dams. Over 300 miles of formerly productive habitat is inaccessible or inundated by reservoirs.
26	*Recommendations*	• Continue to monitor impacts of the operation of dams on salmonids & success of reintroduction efforts above the dams. • Habitat restoration above the dams will provide minimal benefits to salmon recover without development of sustainable wild runs. • Develop critical areas ordinances to ensure protection of habitat for listed fish species • Decommission or repair roads that are contributing to chronic sediment to stream systems. • Increase LWD supplies in stream systems – both short- & long-term. • Speed the recruitment of mature conifers within riparian areas. • Reduce excessive water temperatures, especially in Coweeman, Toutle & Tilton Subbasins. • Augment stream flows & enhance rearing habitat during low-flow periods. • Maintain at least 60% of vegetation within each subbasin in trees > 25 years old to increase hydrologic maturity & minimize impacts to stream channels of increased peak flows.
26	Coweeman	• Floodplain habitat in lower 20 miles of the Cowlitz mainstem & lower Coweeman filled with Mount St. Helens deposits & disconnected from the river. • Rearing & over-wintering habitat very limited. • Basin hydrologically immature & subject to increase peak flows due to extensive logging & high road densities. • Excessive fine sediments to stream channels due to high road densities & 69 miles of stream adjacent roads. • Poor riparian conditions & LWD levels, especially along lower reaches due to diking & development. • Elevated water temperatures & turbidity in Coweeman due to lack of riparian cover. • Water quality in Cowlitz River generally good.
26	*Habitats to be Protected*	Fall chinook spawning & rearing habitat within mainstem Coweeman River from the mouth of Goble Creek (RM 11.4) to Baird Creek (RM 25.9). • Floodplain habitat between RM 4 & RM 7.5 within mainstem the Coweeman River.

Table IV-6

WRIA	BASIN	LIMITING FACTOR
		• Most productive tributaries to the subbasin, including Mulholland, Baird & Goble creeks (in order of priority).
26	*Recommendations*	• Reduce excessive water temperatures. • Decommission or repair road systems contributing sediment to stream channels (Rose Valley Road contributes 351 metric tons/year to Coweeman). • Increase instream LWD in appropriate stream channels. • Increase instream LWD in lower Cowlitz & Coweeman Rivers to increase & enhance off-channel & floodplain habitat. • Reduce land use activities within the subbasin that contribute to water quality problems (especially temperature & turbidity).
26	Lower Cowlitz	• Complete fish passage barrier caused by Mayfield Dam, blocking upstream passage to 80% of the historic habitat. • Altered hydrology due to Mayfield Dam. • Movement of sediments to downstream habitats blocked by Mayfield Dam. • In the mainstem Cowlitz, spawning & rearing habitat for fall chinook & steelhead limited to 8-mile section due to the Mayfield Dam. • Fish passage barriers in a number of the tributaries. • Key habitat areas & habitat diversity significantly limited in the mainstem Cowlitz & tributaries due to channel simplification & diking. • Riparian function substantially reduced due to grazing, agriculture, forestry & residential & commercial development. • Increased bank instability & associated excessive fine sediments throughout subbasin due to grazing, agriculture, forestry & residential & commercial development.
26	*Habitats to be Protected*	• Spawning & rearing habitat for fall chinook & steelhead in the side channels within the mainstem Cowlitz. • Monahan Creek provides important coho, steelhead, & fall chinook habitat. Characterized as having the best tributary habitat in the subbasin. • The upper reaches of Olequa (above Winlock) & Delameter creeks provide important spawning & rearing habitat for steelhead, cutthroat, & coho. • Upper Lacamas Creek may support a small population of chum salmon.
26	*Recommendations*	• Assess & mitigate for negative impacts to all anadromous fish species from the operation of the dams. • Restore & enhance side channels below the dams that provide critical spawning & rearing habitat for fall chinook & winter steelhead. Maintain & restore riparian buffers, fence cattle out of streams, & minimize activities adjacent to streams that negatively impact anadromous habitat.

WRIA	BASIN	LIMITING FACTOR
26	Toutle River	• Severely impacted salmonid populations & habitat due to 1980 eruption of Mount St. Helens. Most systems are naturally recovering except for North Fork Toutle. • Limited floodplain, off-channel & pool habitat due to 1980 eruption. • High width-to-depth ratios, poor riparian conditions & associated elevated stream temperatures. • Lack of instream cover & LWD, & unstable substrate conditions. • Increased peak flows & channel instability due to hydrologic immaturity & high road densities. • Excessive amounts of fine sediments due to high road densities & numerous stream adjacent roads. • Silver Lake watershed – access & water quality major limiting factors.
26	*Habitat to be Protected*	• South Fork & low-gradient reaches of its tributaries contained the most important habitat within the Toutle subbasin. • Elk & Devils creeks are the most productive steelhead tributaries to the Green River. • Hoffstadt & Alder Creeks are the most productive in the North Fork Toutle watershed. • Upper Wyant Creek provides important low-gradient coho habitat.
26	*Recommendations*	• Removal or alteration of the sediment retention structure (SRS) to facilitate natural recovery of the North Fork Toutle & downstream systems. • Address water quantity & water quality problems within the Silver Lake watershed. • Reduce road densities & the miles of stream adjacent roads within the subbasin. • Assess the condition of abandoned roads in the upper Toutle subbasin. • Replant degraded riparian areas with native conifers. • Enhance or restore off-channel rearing habitat.
26	Mayfield/Tilton	• Complete barrier due to Mayfield Dam. • Inundation of productive habitat & creation of predator habitat due to reservoir conditions. • Tilton River - Increased peak flows, inputs of fine sediments & channel instability due to timber harvest, high road densities & numerous stream adjacent roads. • Tilton River – over-winter survival is below expectations due to elevated peak flows & lack of pools & off-channel habitat for refuge. • Tilton River – spawning gravels scoured from many areas due to high flows & lack of LWD.

Table IV-6

WRIA	BASIN	LIMITING FACTOR
26	*Habitats to be Protected*	• Side-channel habitat below the town of Morton provides critical areas with refuge from high flows. • Winston Creek supports a “healthy” run of resident cutthroat trout. • The South Fork Tilton, the mainstem Tilton from Nineteen Creek (RM 22.9) to the falls (RM 25), & the West Fork Tilton provide some of the best habitat within the subbasin. • Coon, Snow, & Trout creeks provide ideal summer-rearing areas for steelhead & resident trout.
26	*Recommendations*	• Monitor & increase efficiency of reintroduction efforts above the dams. Downstream migration success is critical to these efforts. • Increase rearing success in this subbasin by upgrading road locations, crossings, & other floodplain constrictions, reduce road densities, maintain hydrologic maturity, & restore & enhance floodplain connections & rearing habitat. • Supplement LWD in appropriate stream channels to provide instream structure & cover. • Enhance pool quality & spawning habitat with instream LWD. • Establish functioning riparian corridors within the subbasin to increase water quality & recruitment potential for LWD.
26	Riffle Lake	• Complete barrier due to Mossyrock Dam. • Downstream migrants (coho & chinook) unable to navigate 23-mile long lake. • Reintroduction of anadromous salmonids not feasible until downstream migration addressed.
26	Cispus River	• Natural upstream passage & downstream migration blocked by a system of dams. • Downstream migrants captured at Cowlitz Falls Dam & transported below the dams. • Reduction in spawning, incubation, & fry colonization habitat & creation of predator habitat in lower reaches of Cispus River & Copper Canyon Creek by Lake Scanewa. • Increased peak flows, excessive sediment deliverty to streams, bank instability due to road construction & timber harvests. • Reduction of riparian function & instream LWD due to excessive road construction & timber harvest. • Some areas in subbasin (though limited) have properly functioning habitat.
26	*Habitats to be Protected*	• Highest priority – protect North Fork Cispus system. Provides some of the best functional habitat in the subbasin. • Off-channel habitat within the mainstem Cispus between Iron Creek (RM 8.2) & the North Fork Cispus (RM 19.9) provides important rearing habitat for juveniles. • Enhance the fair-quality habitats in the North Fork Cispus, Yellowjacket Creek, & Greenhorn Creek, (in order of priority). • Maintain the high-quality habitats in Woods, Orr, & Iron

Table IV-6

WRIA	BASIN	LIMITING FACTOR
		creeks.
26	*Recommendations*	• Reintroduction efforts in the entire subbasin are dependent upon successful operation of the Cowlitz Falls Fish Collection Facility. • Improvements of capture efficiency at the Cowlitz Falls dam critical to recovery efforts. • Address road related problems on USFWS land that reduce floodplain connectivity & limit rearing habitat within the subbasin. • Enhance existing instream habitat by supplementing LWD. Utilize LWD that collects at Mossyrock Dam for projects within the Cispus subbasin. • Manage early- & mid-structural stands within riparian reserves to develop late-structural characteristics in the Cispus subbasin. • Flow (cfs) thresholds for drawdowns should be reevaluated, & if possible increased, to assure that juveniles are not flushed over the dam into Riffe Lake.
26	Upper Cowlitz	• Natural upstream passage & downstream migration blocked by a system of dams. • Downstream migrants captured at Cowlitz Falls Dam & transported below the dams. • Trap efficiency varies with flow & smolts often flushed into Riffle Lake during drawdowns. • Inundation of spawning, incubation & fry colonization habitat & creation of predator habitat by Lake Scanewa. • Natural barriers to anadromous fish passage on many tributaries within 1-2 miles of the confluence with the upper Cowlitz River. • Large portion of subbasin habitat located in the low-gradient areas of the tributaries. • Low-flow passage problems & reduced habitat quality in tributaries due to channel alterations & increased sediment inputs. • Limited pool habitat, cover & habitat diversity in mainstem upper Cowlitz & lower reaches of tributaries due to lack of LWD. • LWD recruitment is low.
26	*Habitat to be Protected*	• Pristine spawning & rearing habitat critical to spring chinook in the lower reaches of the Ohanapecosh & Clear Fork. • Critical spawning & rearing habitat for all species in low-gradient tributaries. • Skate Creek has the best available habitat in the upper subbasin. • Riparian habitat along the mainstem Cowlitz & tributaries.
26	*Recommendations*	• Continue efficiency monitoring at the dam & improve the efficiency of the collection equipment & process. • Increase instream cover & habitat diversity in the upper reaches of Lake Skanewa to reduce the chance of flushing juveniles during drawdowns. • Enhance & restore rearing & spawning habitat within the low-gradient reaches of tributary habitat.

Table IV-6

WRIA	BASIN	LIMITING FACTOR
		• Restore riparian habitat along the mainstem Cowlitz & its tributaries. • Supplement LWD in appropriate response reaches.
27	Entire WRIA	• LWD abundance below habitat standards. • Poor riparian conditions. • Impaired water quantity – low flows & increased peak flows. • Most of the historic off-channel & floodplain habitat has been disconnected from the river due to diking & hardening the channels.
27	*Recommendations*	• Develop or revise & update land use ordinances that are meant to protect critical habitat for listed fish species. • Protect & enhance riparian habitat with sufficiently sized buffers & speed recruitment of conifers to increase the potential future supply of LWD; • Supplement LWD within productive tributaries after careful consideration of the hydraulics & suitability of the site; • Identify ways to reduce water temperatures, increase water quality, augment minimum streamflows, & replace passage barriers.
27	Kalama River	• Loss of riparian function & instream LWD due to excessive timber harvest. • Alternations in hydrology due to excessive timber harvest. • Most of the historic floodplain diked & disconnected from the river to protect industrial development & I-5 highway. • Rearing & over-wintering habitat for juvenile coho degraded by loss of floodplain habitat. • Creation of predator habitat & excessive water temperatures at the mouth of the Kalama due to growth of a wide & shallow bar. • Limited access & rearing habitat during low flows in many tributaries due to accumulation of coarse sediments at the mouths. • Impaired spawning substrates in mainstem Kalama due to accumulation of fine sediments.
27	*Habitat to be Protected*	• Fall chinook, chum spawning grounds in the lower mainstem. • Winter steelhead spawning & rearing habitat in the mainstem above the lower falls. • Lower river tributaries & off-channel rearing areas for coho salmon. • The five most productive tributaries for summer steelhead (Gobar, Wildhorse, Langdon, & Lakeview Peak creeks, & the North Fork Kalama).
27	*Recommendations*	• Assess & develop solutions to conditions on the Kalama River bar. • Assess & develop solutions to the extensive deposits of coarse sediments that have accumulated in tributary mouths. • Increase &/or enhance off-channel & rearing habitat within the Kalama River.

Table IV-6

WRIA	BASIN	LIMITING FACTOR
		• Repair &/or decommission roads. • Minimize the amount of timber harvest occurring within the basin at any one time to maintain hydrologic maturity & minimize peak flows.
27	Lower Lewis River	• System of dams block passage to 80% of the historic anadromous habitat. • Rearing habitat for juvenile salmonids is limited by lower floodplain being diked & disconnected from the river. • Cedar Creek provides majority of spawning & rearing habitat for steelhead & coho for the Lewis River system. ➢ elevated water temperatures, low summer flows, & spawning gravels cemented with fine sediments all limiting factors. • Bull trout/Dolly Varden found above dams in reservoirs & in Cougar, Rush & Pine creeks. ➢ excessive fine sediment, loss of riparian habitat, & elevated stream temperatures due to the eruption of Mt. Saint Helens, timber harvest & road construction.
27	*Habitat to be Protected*	• The Cedar Creek basin provides most of the spawning & rearing habitat for coho, & steelhead within the Lewis River. • Native fall chinook spawning grounds & juvenile rearing areas. • Rush, Cougar, & Pine creeks provide the only spawning habitat for bull trout.
27	*Recommendations*	• Reintroduce anadromous fish above the dams. • Increase &/or enhance off-channel & rearing habitat within the lower Lewis River & within Cedar Creek. • Reduce fine sediment inputs to Cedar Creek & its tributaries. • Reduce water temperatures & augment low flows within the Cedar Creek basin.
27	East Fork Lewis River	• Large portions of East Fork watershed repeatedly burned during the first half of the century. • Hydrology, structure, composition, & age-class distribution of plant communities impacted by burning. • Riparian & instream habitat impacted by burning. • Elevated water temperatures in many tributaries & in the lower East Fork. • Increased high rates of erosion, channel instability, & loss of spawning habitat for fall chinook due to instream gravel pits. • Floodplain habitat diked or disconnected from the river. • Over-winter habitat reduced. • Rearing habitat in the summer for juvenile salmon & steelhead limited by low flows.
27	*Habitat to be Protected*	• The lower 10 miles of the East Fork provides most of the limited floodplain habitat that remains within WRIA 27, & critical fall chinook & chum spawning habitat. • Rock Creek (upper) & the mainstem above Sunset Falls provide the most critical winter & summer steelhead spawning & rearing habitat in the East Fork basin.

Table IV-6

WRIA	BASIN	LIMITING FACTOR
27	*Recommendations*	• Assess changes in bank & channel stability, erosion rates, water quality, & predation rates resulting from the recent avulsion into the Ridgefield Pits. • Identify both short-& long-term solutions that will help restore Ridgefield Pits habitat. • Reduce water temperatures & improve overall water quality, & to augment flow during low-flow periods. • Reconnect & enhance limited off-channel & floodplain habitat.

Region 4 – Middle and Upper Columbia River Watersheds

Geographic Boundaries

The Middle and Upper Columbia River Watersheds include:

- Pend Oreille Lake Watershed [HUC[76] 17010214 and WRIA[77] 57]
- Priest Watershed [HUC 17010215 and WRIA 62]
- Pend Oreille Watershed [HUC 17010216 and WRIA 62]
- Coeur d'Alene Lake Watershed [HUC 17010303 and WRIA 56]
- Upper Spokane Watershed [HUC 17010305 and WRIA 57]
- Hangman Watershed [HUC 17010306 and WRIA 56]
- Lower Spokane Watershed [HUC 17010307 and WRIA 54]
- Little Spokane Watershed [HUC 17010308 and WRIA 55]
- Franklin D. Roosevelt Lake Watershed [HUC 17020001 and WRIA 53, 58, & 61]
- Kettle Watershed [HUC 17020002 and WRIA 60]
- Colville Watershed [HUC 17020003 and WRIA 59]
- Sanpoil Watershed [HUC 17020004 and WRIA 52]
- Chief Joseph Watershed [HUC 17020005 and WRIA 49 and 50]
- Okanogan Watershed [HUC 17020006 and WRIA 49]
- Similkameen Watershed [HUC 17020007 and WRIA 48 and 49]
- Methow Watershed [HUC 17020008 and WRIA 48]
- Lake Chelan Watershed [HUC 17020009 and WRIA 47]
- Upper Columiba – Entiat Watershed [HUC 17020010 and WRIA 40, 44, and 46]
- Wenatchee Watershed [HUC 17020011 and WRIA 45]
- Moses Coulee Watershed [HUC 17020012 and WRIA 44]
- Upper Crab Watershed [HUC 17020013 and WRIA 43]
- Banks Lake Watershed [HUC 17020014 and WRIA 42]
- Lower Crab Watershed [HUC 17020015 and WRIA 41]
- Upper Columbia – Priest Rapids Watershed [HUC 17020016 & WRIA 36 & 40]
- Upper Yakima Watershed [HUC 17030001 and WRIA 39]

[76] Hydrologic Unit Code (HUC)
[77] Water Resource Inventory Area (WRIA)

- Naches Watershed [HUC 17030002 and WRIA 36]
- Lower Yakima Watershed [HUC 17030003 and WRIA 39]
- Middle Columbia – Lake Wallula Watershed [HUC 17070101 and WRIA 31]
- Walla Walla Watershed [HUC 17070102 and WRIA 32]
- Middle Columbia – Hood Watershed [HUC 17070105 and WRIA 29 and 30]
- Klickitat Watershed [HUC 17070106 and WRIA 30]

The watersheds stretch into Adams, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Grant, Kittatas, Klickitat, Lincoln, Okanogan, Pend Oreille, Skamania, Spokane, Stevens, Walla Walla, and Yakima Counties.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species descriptions and the factors to their decline, see Appendix A.

Birds:

- Bald eagle *(Haliaeetus leucocephalus)* Threatened
- Marbled murrelet *(Brachyramphus marmoratus)* Threatened
  Designated critical habitat
  [Chelan, Kittatas and Yakima Counties only]
- Northern spotted owl *(Strix occidentalis caurina)* Threatened
  Designated critical habitat
  [Chelan, Kittatas, Klickitat, Okanogan, and Yakima Counties only]

Fish:

- Columbia River bull trout *(Salvelinus confluentus)* Threatened
- Lower Columbia River chinook (*Oncorhynchus tshawytscha)* Threatened
  Designated critical habitat
  [Downstream of the Grays and White Salmon Rivers only]
- Middle Columbia River steelhead *(Oncorhynchus mykiss)* Threatened
  [Downstream of the Yakima River only]
- Snake River fall chinook (*Oncorhynchus tshawytscha)* Threatened
  Designated critical habitat
  [Columbia River mainstem only]
- Snake River spring/summer chinook (*Oncorhynchus tshawytscha)* Threatened
  Designated critical habitat
  [Columbia River mainstem only]
- Snake River sockeye (*Oncorhynchus nerka)* Endangered
  Designated critical habitat
  [Columbia River mainstem only]

- Snake River steelhead *(Oncorhynchus mykiss)* — Threatened
  Designated critical habitat
  [Columbia River mainstem only]
- SW Washington/Columbia River cutthroat trout (*Oncorhynchus clarki clarki*) — Threatened (Proposed)
  [Downstream of the Klickitat River only]
- Upper Columbia River spring chinook (*Oncorhynchus tshawytscha)* — Endangered
  Designated critical habitat
- Upper Columbia River steelhead *(Oncorhynchus mykiss)* — Endangered
  Designated critical habitat

Mammals:

- Canada lynx (*Lynx canadensis*) — Threatened
- Gray wolf *(Canis lupus)* — Endangered
  [Cascades and Selkirk Mountains]
- Grizzly bear *(Ursus arctos horribilis)* — Threatened
  [Cascades and Selkirk Mountains]
- Pygmy Rabbit (*Brachylagus idahoensis)* — Endangered
- Woodland caribou (*Rangifer tarandus caribou)* — Endangered
  [Pend Oreille County only]

Plants:

- Utes ladies'-tresses (*Spiranthes diluvialis)* — Threatened
- Showy stickseed (*Hackelia venusta)* — Threatened
  [Chelan County only]
- Wenatchee Mountains checkermallow (*Sidalcea oregana var. calva)* — Endangered
  Proposed critical habitat
  [Chelan County only]
- Spalding's silene (*Silene spaldingii)* — Threatened
  [Lincoln and Spokane Counties only]

Land Use Activities

Timber Harvest

Timber harvest activities in the Middle and Upper Columbia River watersheds occur alond the western portion of the region in the Cascade Mountains within and near the Gifford-Pinchot National Forest, Mount Baker-Snoqualamie National Forest, and Wenatchee National Forest. Additional timber harvest activities occur in the northeast portions of the region within and near the Colville National Forest, Kaniksu National Forest and Okanogan National Forest.

As shown in Table IV-7, many of the waterbodies exceed state standards for temperature, sedimentation, and dissolved oxygen. Waterbody impairments often associated with areas where the timber has been overharvested, high forest road densities exist, and riparian habitat has been removed.

Agricultural Production

Significant agricultural production occurs through out the Middle and Upper Columbia River watershed. Conversion of habitat to agricultural lands has resulted in loss of riparian habitat, unstable stream banks with poor cattle exclusion devices, excessive chemical levels in the water associated with pesticides and herbicides, high water temperatures, low dissolved oxygen levels, high levels of fecal coliform, and low flow problems due to water withdrawals for irrigation. As shown in Table IV-8, several water bodies have issues with fish passage either due to road crossing or small dams constructed for irrigation of agricultural lands.

Agricultural production has also increased disturbance related to invasive plant species. Purple loosestrife, an invasive plant species, has taken over 23,000 acres of wetlands in Grant County alone, altering important habitat for animal and plant species.[78]

Urban Development

The primary impact to the Middle and Upper Columbia River watersheds by urban development is the extensive series of dams and hydropower plants throughout the region. Ten hydropower facilities exist on the mainstem Columbia River. The creation of the dams have restricted stream flows, flooded wildlife habitat, and introduced chemicals associated with hydropower facilities and transformers into the water bodies (See Table IV-7). The 51 river miles of Hanford Reach are the only remaining non-tidal unimpounded portions of the Columbia River.[79]

[78] WDNR (2000), p. 49
[79] WDNR (2000), p. 26

The main populations in the region are centered in the Spokane area in the northeast, Ellensberg and Yakima in the center of the region, and the Tri-Cities of Richland, Kennewick and Pasco in the southern portion of the region. Outside of these major urban areas, the majority of residential development is on septic systems. Common water contaminants associated with urban development and residential septic systems include excessive water temperatures, lowered dissolved oxygen levels, fecal coliform, and chemicals associated with pesticides and urban runoff. Three ports exist within the region – Bingen, Pasco and Richland. As shown in Tabel IV-7, industrial chemcial contaminants associated with port activities are at elevated levels in the water column.

Protected areas

The following federally protected areas occur in the Middle and Upper Columbia River Watersheds: Columbia National Wildlife Refuge (23,000 acres), Conboy Lake National Wildlife Refuge (564 acres), Little Pend Oreille National Wildlife Refuge (41,000 acres), McNary National Wildlife Refuge (3,629 acres), Saddle Mountain National Wildlife Refuge (30,190 acres plus 730 acres of lake), Toppenish National Wildlife Refuge (1,763 acres), Columbia River Gorge National Scenic Area (80 river miles and 292,500 acres), Klickitat Wild-n-Scenic River (Total 10 miles designated Recreational)[80], White Salmon Wild-n-Scenic River (Total of 9 miles designated Scenic)[81], Alpine Lakes Wilderness (394,000 acres)[82], Glacier Peak Wilderness (576,865 acres)[83], Henry M. Jackson Wilderness (102,673 acres)[84], Goat Rock Wilderness (105, 023 acres)[85], Mt. Adams Wilderness (47,280 acres), Norse Peak Wilderness (51,000 acres), Salmo-Priest Wilderness, Hanford Historical and Ecological National Monument (350,042 acres), Colville National Forest, Gifford Pinchot National Forest (1.3 million acres)[86], Mt.

[80] Designated area: From the confluence with Wheeler Creek, near the town of Pitt, to the confluence with the Columbia River.
[81] Designated area: From its confluence with Gilmer Creek, near the town of B Z Corner, to its confluence with Buck Creek.
[82] A portion of the Alpine Lakes Wilderness is located in Region 2
[83] A portion of the Glacier Peak Wilderness is located in Region 2.
[84] A portion of the Henry M. Jackson Wilderness is located in Region 2.
[85] A portion of the Goat Rocks Wilderness is located in Region 3
[86] A portion of the Gifford Pinchot National Forest is located in Region 3.

Baker-Snoqualmie National Forest, Okanogan National Forest (1.7 million acres), and the Wenatchee National Forest.

The following Washington State protected Natural Area Preserves (NAP) occur in the Middle and Upper Columbia River Watersheds: Badger Gulch (Klickitat County – 180 acres), Barker Mountain (Okanogan County – 120 acres), Castle Rock (Grant County – 81 acres), Chopaka Mountain (Okanogan County – 2,764 acres), Cleveland Shrub Steppe (Klickitat County – 640 acres), Columbia Hills (Klickitat County – 3,593 acres), Davis Canyon (okanogan County – 293 acres), Entiat Slopes (Chelan County – 640 acres), Little Pend Oreille River (Stevens County – 253 acres), Methow Rapids (Okanogan County – 66 acres), Pinecroft (Spokane County – 100 acres), Riverside Breaks (Okanogan County – 36 acres), Selah Cliffs (Yakima County – 64 acres), Spring Creek Canyon (Lincoln County – 235 acres), Trout Lake (Klickitat County – 918 acres), The Two-Steppe (Douglas County – 355 acres), and Upper Dry Gulch (Chelan County – 320 acres).

The Washington State protected Natural Resource Conservation Areas (NRCAs) occurring in the Middle and Upper Columbia River Watersheds include: Dishman Hills (Spokane County – 518 acres), Klickitat Scenic River (Yakima County – 470 acres), and White Salmon Oak (Klickitat County – 315 acres).

The following areas in the Middle and Upper Columbia River watersheds are designated Wildlife Areas protected by Washington Department of Fish and Wildlife: Barks Lake Wildlife Area (Grant County), Billy Clapp Lake Wildlife Area (Grant County – 4,000 acres), Byron Wildlife Area (Yakima County – 400 acres), Chelan Buttes Wildlife Area (Chelan County – 8,200 acres), Chesaw Wildlife Area (Okanogan County – 2,480 acres), Chiliwist Wildlife Area (Okanogan County – 6,400 acres), Colockum Wildlife Area (Chelan and Kittitas Counties – 88,000 acres), Cowiche Wildlife Area (Yakima County – 4,526 acres), Desert Wildlife Area (Grant County – 35,100 acres), Driscoll Wildlife Area (Okanogan County – 220 acres), Gloyd Seeps Wildlife Area (Grant County – 8,000 acres), Goose Lakes Wildlife Area (Grant County – 3,626 acres), I-82 Wildlife Area (Yakima County), Lower Crab Creek Wildlife Area (Grant County - 17,000 acres),

Le Clerc Wildlife Area (Pend Oreille County), Lt. Murray Wildlife Area (Kittitas County – 50,000 acres), Methow Wildlife Area (Okanogan County – 14,500 acres), Oak Creek Wildlife Area (Yakima County – 42,000 acres), Potholes Wildlife Area (Grant County – 32,500 acres), Priest Rapids Wildlife Area (Grant County), Quilomena Wildlife Area (Quincy Wildlife Area (Grant County – 15,266 acres), Rattlesnake Slope Wildlife Area (Yakima County), Scotch Creek Wildlife Area (Okanogan County – 9,067 acres), Seeps Lake (Adams and Grant Counties – 4,537 acres), Shreman Wildlife Area (Ferry County – 9,982 acres), Sinalahekin Wildlife Area (Okanogan County – 13,814 acres), Sun Lakes Wildlife Area (Grant County – 9,140 acres), Sunnyside Wildlife Area (Yakima County – 2,786 acres), Swakane and Entiat Wildlife Area (Chelan County – 19,200 acres), Swanson Lakes Wildlife Area (Lincoln County – 19,000 acres), Tunk Wildlife Area (Okanogan County – 1,080 acres), Wahluke Slope Wildlife Area (Grant County – 55,000 acres), WB-10 Wildlife Area (Grant County – 1,871 acres), Wells Wildlife Area (Okanogan and Douglas Counties – 8,681 acres), Wenas Wildlife Area (Kittitas County – 104,000 acres), Whiskey Dick Wildlife Area (Kittitas County – 28,549 acres), and Winchester Lakes Wildlife Area (Grant County – 1,950 acres).

Private protected lands in the Middle and Upper Columbia Watersheds include: The Nature Conservancy – Pierce Island Preserve (Grant County – 200 acres) and Yakima River Canyon Preserve (Yakima County – 105 acres); Chelan-Douglas Land Trust (Chelan and Douglas County); Cold Spring Conservancy (Kittitas County); Cowiche Canyon Conservancy (Yakima County); Inland Northwest Land Trust (Spokane County), Methow Conservancy (Okanogan County); Wilderness Land Trust (Klickitat County); and Yakima Greenway Foundation (Yakima County).

Impaired Waterbodies

All or portions of the waterbodies listed in Table IV-7 have been listed under Section 303(d) of the Clean Water as impaired waterways. The parameter(s) exceeded are noted for each waterbody. Full extents of the listed waterbodies may be obtained from Washington State Department of Ecology in the “Final 1998 Section 303(d) Listed Waterbodies for Washington State”, dated April 4, 2000.

Table IV-7: Section 303(d) Listed Waterbodies in Middle and Upper Columbia River Watersheds

Source: Final 1998 Section 303(d) List, Washington State Department of Ecology, April 4, 2000.

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
29	BEAR CREEK	Temperature
29	EIGHTMILE CREEK	Temperature
29	INDIAN CREEK	Temperature
29	RATTLESNAKE CREEK	Fecal Coliform, Temperature
29	TROUT LAKE CREEK	Fecal Coliform
29	WHITE SALMON RIVER	Fecal Coliform
30	BLOCKHOUSE CREEK	Instream Flow
30	BLOODGOOD CREEK	Instream Flow
30	BOWMAN CREEK	Instream Flow
30	BUTLER CREEK	Temperature
30	COLUMBIA RIVER	Temperature, Total Dissolved Gas
30	LITTLE KLICKITAT RIVER	Instream Flow, Temperature
30	LITTLE KLICKITAT RIVER, EAST PRONG	Temperature
30	LITTLE KLICKITAT RIVER, WEST PRONG	Temperature
30	MILL CREEK	Instream Flow
30	SWALE CREEK	Instream Flow, Temperature
31	COLUMBIA RIVER	Arsenic, Sediment Bioassay, Temperature, Total Dissolved Gas, pH
36	EAST POTHOLES CANAL	Dissolved Oxygen, Temperature
36	ELTOPIA BRANCH CANAL	Temperature
36	ESQUATZEL COULEE	Dissolved Oxygen, pH, Temperature
36	MATTAWA DRAIN	Temperature
36	MATTAWA WASTEWAY	Temperature
36	POTHOLES CANAL	Dissolved Oxygen, Temperature
36	SCBID PE 16.4 WASTEWAY	Temperature
36	SCOOTENEY WASTEWAY	Dissolved Oxygen, pH, Temperature
36	WB5 WASTEWAY #1	Temperature
37	GIFFIN LAKE	Total Phosphorus
37	GRANGER DRAIN	4,4'-DDD, 4,4'-DDE, Ammonia-N, DDT, Dieldrin, Dissolved Oxygen, Endosulfan, Fecal Coliform, pH
37	SPRING CREEK	Temperature
37	SULPHUR CREEK WASTEWAY	4,4'-DDD, 4,4'-DDE, DDT, Dieldrin, Endosulfan, Temperature
37	WIDE HOLLOW CREEK	4,4'-DDD, 4,4'-DDE, DDT, Dieldrin, Dissolved Oxygen, Endosulfan, Fecal Coliform, Temperature
37	YAKIMA RIVER	4,4'-DDD, 4,4'-DDE, Arsenic, DDT, Dieldrin, Dissolved Oxygen, Endosulfan, Fecal Coliform, Instream Flow, Mercury, PCB-1254, PCB-1260, pH, Silver, Temperature, Turbidity
38	AMERICAN RIVER	Temperature

Table IV-7

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
38	BEAR CREEK	Temperature
38	BLOWOUT CREEK	Temperature
38	BUMPING RIVER	Temperature
38	COWICHE CREEK	Fecal Coliform, Instream Flow, Temperature
38	COWICHE CREEK, N.F.	Fecal Coliform, Temperature
38	COWICHE CREEK, S.F.	Fecal Coliform, Temperature
38	CROW CREEK	Temperature
38	GOLD CREEK	Temperature
38	LITTLE NACHES RIVER	Temperature
38	LITTLE RATTLESNAKE CREEK	Temperature
38	MATHEW CREEK	Temperature
38	MYRON LAKE	Ammonia-N
38	NACHES RIVER	pH, Silver, Temperature
38	NILE CREEK, N.F.	Temperature
38	RATTLESNAKE CREEK	Temperature
38	REYNOLDS CREEK	Temperature
38	TIETON RIVER, S.F.	Temperature
39	BIG CREEK	Instream Flow, Temperature
39	BLUE CREEK	Temperature
39	CABIN CREEK	Temperature
39	CHERRY CREEK	4,4'-DDE, DDT, Dieldrin, Temperature
39	CLE ELUM RIVER	Temperature
39	COOKE CREEK	Dissolved Oxygen, Fecal Coliform, Temperature
39	COOPER RIVER	Temperature
39	GALE CREEK	Temperature
39	GOLD CREEK	Temperature
39	IRON CREEK	Temperature
39	LOG CREEK	Temperature
39	LOOKOUT CREEK	Temperature
39	MANASTASH CREEK	Instream Flow
39	MANASTASH CREEK, S.F.	Temperature
39	MEADOW CREEK	Temperature
39	NANEUM CREEK	Temperature
39	SELAH DITCH	Ammonia-N, Chlorine, Dissolved Oxygen
39	STAFFORD CREEK	Temperature
39	SWAUK CREEK	Temperature
39	TANEUM CREEK	Instream Flow, Temperature
39	TANEUM CREEK, S.F.	Temperature
39	TEANAWAY RIVER	Instream Flow, Temperature
39	TEANAWAY RIVER, M.F.	Temperature
39	TEANAWAY RIVER, W.F.	Temperature
39	THORP CREEK	Temperature
39	WAPTUS RIVER	Temperature
39	WENAS CREEK	Instream Flow
39	WILLIAMS CREEK	Temperature
39	WILSON CREEK	Fecal Coliform, Temperature
39	YAKIMA RIVER	4,4'-DDE, Cadmium, Copper, DDT, Dieldrin, Dissolved Oxygen, Mercury, Silver,

Table IV-7

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
		Temperature
40	COLUMBIA RIVER	Total Dissolved Gas
41	CRAB CREEK	4,4'-DDE, PCB-1254, PCB-1260, pH, Temperature
41	CRAB CREEK LATERAL	Temperature
41	EAST POTHOLES CANAL	Dissolved Oxygen, Temperature
41	FRENCHMAN HILLS WASTEWAY	pH, Temperature
41	LIND COULEE	Dissolved Oxygen, pH, Temperature
41	POTHOLES LAKE	Dieldrin
41	RED ROCK COULEE	Dissolved Oxygen, pH, Temperature
41	ROCKY FORD CREEK	Dissolved Oxygen, pH, Temperature
41	SAND HOLLOW CREEK	pH, Temperature
41	W645W WASTEWAY	Dissolved Oxygen, Temperature
41	WEST CANAL	Temperature
41	WINCHESTER WASTEWAY	pH, Temperature
42	MAIN CANAL	Dissolved Oxygen, Temperature
43	CRAB CREEK	pH
43	MEDICAL, WEST LAKE	Ammonia-N, Fecal Coliform
44	COLUMBIA RIVER	Temperature
45	BRENDER CREEK	Dissolved Oxygen, Fecal Coliform
45	CHIWAUKUM CREEK	Temperature
45	CHUMSTICK CREEK	Dissolved Oxygen, Fecal Coliform, Instream Flow, pH
45	COLUMBIA RIVER	Total Dissolved Gas, Water Column Bioassay
45	ICICLE CREEK	Dissolved Oxygen, Instream Flow, pH, Temperature
45	LITTLE WENATCHEE RIVER	Temperature
45	MISSION CREEK	4,4'-DDE, 4,4'-DDT, DDT, Fecal Coliform, Guthion(azinphos-methyl), Instream Flow, Temperature
45	NASON CREEK	Temperature
45	PESHASTIN CREEK	Instream Flow, Temperature
45	WENATCHEE RIVER	Dissolved Oxygen, Instream Flow, pH, Temperature
46	ENTIAT RIVER	Instream Flow
47	CHELAN LAKE	4,4'-DDE, PCB-1254, PCB-1260
47	COLUMBIA RIVER	Temperature, Total Dissolved Gas
47	FIRST CREEK	Dissolved Oxygen
47	MITCHELL CREEK	pH
47	ROSES (ALKALI) LAKE	4,4'-DDE
48	BEAVER CREEK	Instream Flow
48	CHEWACK RIVER	Instream Flow
48	EARLY WINTERS CREEK	Instream Flow
48	METHOW RIVER	Instream Flow, Temperature
48	TWISP RIVER	Instream Flow, Temperature
48	WOLF CREEK	Instream Flow
49	NINEMILE CREEK	DDT
49	OKANOGAN RIVER	4,4'-DDD, 4,4'-DDE, Dissolved Oxygen,

Table IV-7

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
		Fecal Coliform, PCB-1254, PCB-1260, Temperature
49	OSOYOOS LAKE	4,4'-DDD, 4,4'-DDE
49	SALMON CREEK	Instream Flow
49	SIMILKAMEEN RIVER	Arsenic, Temperature
49	TALLANT CREEK	DDT
49	UNNAMED CREEK	DDT
50	COLUMBIA RIVER	Total Dissolved Gas
52	GRANITE CREEK	Dissolved Oxygen
52	O'BRIEN CREEK, S.F.	pH
52	SANPOIL RIVER	Dissolved Oxygen
53	COLUMBIA RIVER	Total Dissolved Gas
53	FRANKLIN D. ROOSEVELT LAKE	Dissolved Oxygen, Sediment Bioassay, Temperature
54	CHAMOKANE CREEK	Temperature
54	LONG LAKE (RESERVOIR)	PCB-1242, PCB-1248, PCB-1254, PCB-1260
54	SPOKANE RIVER	Chromium, Lead, PCB-1242, PCB-1248, PCB-1254, PCB-1260, pH, Sediment Bioassay, Temperature, Total Phosphorus, Zinc
55	DEADMAN CREEK	pH, Temperature
55	DRAGOON CREEK	Dissolved Oxygen, Fecal Coliform
55	LITTLE SPOKANE RIVER	Fecal Coliform, PCB-1248, PCB-1254, PCB-1260, pH, Temperature
56	HANGMAN CREEK	Dissolved Oxygen, Fecal Coliform, pH, Temperature
57	NEWMAN LAKE	Total Phosphorus
57	SPOKANE RIVER	Arsenic, Cadmium, Dissolved Oxygen, Lead, PCB-1242, PCB-1248, PCB-1254, PCB-1260, Sediment Bioassay, Zinc
58	FRANKLIN D. ROOSEVELT LAKE	Mercury, Sediment Bioassay
58	SHERMAN CREEK	Temperature
58	SHERMAN CREEK, S.F.	Temperature
59	BLUE CREEK	Dissolved Oxygen, Fecal Coliform
59	CHEWELAH CREEK	Fecal Coliform
59	CHEWELAH CREEK, S.F.	Dissolved Oxygen, Fecal Coliform, pH, Temperature
59	COLVILLE RIVER	Ammonia-N, Chlorine, Dissolved Oxygen, Fecal Coliform, pH, Temperature
59	COTTONWOOD CREEK	Fecal Coliform, Temperature
59	HALLER CREEK	Fecal Coliform
59	HUCKELBERRY CREEK	Fecal Coliform
59	JUMP OFF JOE CREEK	Fecal Coliform
59	LITTLE PEND ORIELLE RIVER	Fecal Coliform
59	MILL CREEK	Fecal Coliform, pH
59	SHEEP CREEK	Dissolved Oxygen, Fecal Coliform
59	SHERWOOD CREEK	Fecal Coliform
59	STARVATION LAKE	Total Phosphorus
59	STENSGAR CREEK	Dissolved Oxygen, Fecal Coliform,

Table IV-7

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
		Temperature
59	STRANGER CREEK	Fecal Coliform
60	COTTONWOOD CREEK	Fecal Coliform
60	LAMBERT CREEK	Fecal Coliform
60	LONE RANCH CREEK	Fecal Coliform
60	MARTIN CREEK	Fecal Coliform
60	PIERRE CREEK	pH
60	ST. PETER CREEK	Fecal Coliform
60	TROUT CREEK, N.F.	Fecal Coliform
61	CROWN CREEK	Fecal Coliform
61	DEEP CREEK	pH

Table IV-8: WRIA 29, 30, 31, 44, 46, 48, & 50 Salmonid Species Limiting Factors by Basin

Source: Washington Conservation Commission (http://www.conserver.org/salmon/index.php3)

WRIA	BASIN	LIMITING FACTORS
29	Wind River Watershed	• An historically important source for production of anadromous fish in the Lower Columbia river basin. • The Wind River remains as a viable anadromous fish producer even though its habitat has been severely impacted. • Historic alterations include: ➢ Hydroelectric development in the White Salmon River. ➢ Construction of Bonneville Dam with its associated pool. ➢ Logging in the Gifford Pinchot National Forest. ➢ Poorly designed & installed culverts, especially along State Highway 14. • Limiting factors include: ➢ Timber harvest impacts with stream cleanouts, timber harvest in the riparian area, a lack of LWD, mass bedload movement. ➢ Presence of a dam with a poorly designed fish ladder. ➢ Loss of floodplain capacity & increased siltation.
29	*Recommendations*	• Removal of Conduit Dam on the White Salmon River – blocks anadramous fish passage at RM 3.3 since 1919. • Continuing ongoing restoration efforts in the U.S. Northwest Forest Plan & with the Wind River Watershed Council.
30	Klickitat Watershed	• 1350 square miles • The Yakima Indian Nation reservation occupies the northern 56% of the watershed. Approximately 90% of the non-reservation land is privately held. • Approximately 75% of the land is forested, & is mostly managed for commercial timber production & grazing. Most of the remaining 25% is agricultural land (orchards, hay, & pasture); of this, about 25% is irrigated. • Urban development is limited to the city of Goldendale (pop. 3500) & the unincorporated towns of Lyle, Klickitat, & Glenwood and, combined with rural residential use, occupies less than one-half of one percent of the watershed. • Fish Passage Limiting Factors: ➢ Lack of access to potential habitat due to the presence of natural barriers to migration is a major limitation of the production potential of the watershed. ➢ Artificial barriers include the Klickitat Hatchery weir, the Old Champion Mill Sluiceway on Snyder Creek, & numerous road culverts on both public & private roads. ➢ Low flow/thermal barriers are found on Swale Creek & the Little Klicktat River. ➢ Poor design & operation of the fishway/tunnel complex at Castile Falls. ➢ Difficult fish passage at Lyle Falls.

Table IV-8

WRIA	BASIN	LIMITING FACTORS
		➢ Difficult fish passage at Little Klickitat Falls. • Floodplains/Wetlands/Riparian Areas limiting factors: ➢ Development of floodplains & wetlands is naturally limited over a large portion of the watershed; deeply incised canyons with narrow valley floors comprise most of the mainstem, as well as substantial portion of most fish bearing tributaries. ➢ Degraded riparian habitat & encroachment of the limited floodplain by roads & rail lines along the Little Klickitat River (RM 12 to RM 18), along Swale Creek (RM 10 to RM ??), & along the mainstem Klickitat River above Castile Falls (RM 77 to RM 85). ➢ In the canyon reaches, riparian areas appear to be relatively intact; steep hillslopes tend to limit access, & so much of the riparian forest remains. ➢ On the plateau reaches where agricultural & urban land uses occur, the riparian forest has been almost entirely removed, or is in a condition such that only minimal amounts of necessary ecological functions can be provided. • Sedimentation & turbidity limiting factors: ➢ Land-use related sediment sources in this watershed occur as a result of forest practices (e.g. harvesting, skidding, & road building across or adjacent to a stream), agricultural practices (e.g. rill irrigation, streamside grazing), or residential or commercial construction (land clearing & excavation in the vicinity of a stream). ➢ Naturally-generated glacial sediments entering the Klickitat River at RM 53.8 & RM 63.1. ➢ Damaged meadows & eroded/compacted streambanks along the Klickitat River (RM 77 to Rm 85). ➢ Eroded/compacted streambanks along the Little Klickitat River (RM 12 to RM 18). ➢ Eroded/compacted streambanks along Swale Creek (RM 10 to RM ??). • Chronic erosion from stream-adjacent logging roads (various locations in the watershed). • Water Quantity/Quality limiting factors: ➢ Insufficient flows to support fish populations (anadramous & resident) in Swale Creek & Little Klickitat River & their tributaries. ➢ High temperatures in Butler Creek due to lack of riparian shading. ➢ Lack of riparian shading along Swale Creek from RM 10 to RM ??, resulting in high temperatures at low flows. ➢ Lack of riparian shading along the Little Klickitat River from RM 12 to RM 18, resulting in high temperatures at low flows.
30	*Recommendations*	• Comprehensive culvert inventory & survey of inaccessible habitat. • Restoration of the Lower Snyder Creek • Assessment of floodplain connectivity & riparian condition,

WRIA	BASIN	LIMITING FACTORS
		with a focus on plateau reaches. • Watershed-scale evaluation on sediment sources & sinks, including relative magnitudes & habitat impacts. • An evaluation of the relative contribution of natural & land use factors (particularly water withdrawals) on low flows in streams identified as "water quality impaired" for instream flows. • Coordination of stream temperature data collection & riparian inventory to identify reaches which are most responsive to riparian zone planting & restoration in streams identified as "water quality impaired" for temperature.
31	Rock-Glade Watershed	• 1650 square miles • Erosion-resistant nature of extensive basalt flows has resulted in the creation of deep (500 to 800 feet), steep-walled canyons & has severely constrained floodplain development along substantial portions of the streams within the watershed. • In headwaters & steep canyon streams, fish habitat quality is generally fair to poor due to natural conditions, with little suitable spawning & rearing habitat. • Below the canyon reaches, streams enter low-gradient alluvial valleys. Fish habitat in these sections is highly variable, ranging from poor to excellent. • Over 90% of land base is privately owned. • Almost 50% of the land is in agricultural use (primarily wheat & other dryland crops). • 37% is in non-forested range. • Less than 10% of the watershed is forested, primarily in the headwaters of Rock Creek & Pine Creek - much of the forested land also has active grazing allotments. • Urban development occupies less than one percent of the watershed & is limited to the city of Kennewick (pop. 49,000) & a number of small, unincorporated towns. • Fish Passage limiting factors: ➢ Barrier culverts at SR 14 on Pine Creek preclude access to potential steelhead habitat. • Floodplains/Wetlands/Riparian areas limiting factors: ➢ Accelerated channel incision (entrenchment, downcutting) due to grazing & trampling by cattle in & near stream banks. ➢ Channel widening & obliteration of riparian zones caused by a 75 to 100 year flood event in 1996. ➢ Cattle watering at, or in the vicinity of, spring areas may have adverse impacts on water quality. ➢ Grazing & forest practices have resulted in removal of or damage to riparian vegetation & compaction & erosion of stream banks & adjacent floodplain areas, adversely impacting functional quality of riparian areas. • Water Quantity/Quality limiting factors: ➢ Low or non-existent flows in all streams during the late

WRIA	BASIN	LIMITING FACTORS
		summer, fall, & early winter will limit or preclude utilization by fall spawning adults (chinook, coho), limit mobility of juveniles of all species, & may result in mortality due to stranding. ➢ High stream temperatures in the lower portions of all streams during the summer & early fall will limit mobility of juveniles of all salmonid species, & may result in mortality due to thermal stress.
31	*Recommendations*	• Restrict grazing activity where functional floodplains & riparian areas are becoming reestablished. • Further investigation of fish utilization & habitat availability & quality, to be conducted on all accessible or potentially accessible streams. • Further investigation of potential barriers should be conducted on all fish bearing streams, using an approved assessment & inventory protocol. • More detailed evaluations of the condition of channels, floodplains, wetlands, & riparian areas. Identification of sediment sources, sinks, & sediment related impacts to habitat. • A stream temperature study to provide a better understanding of the causative factors of high stream temperatures.
44	Moses Coulee Watershed	• 776,222 acres • Salmon distribution & productivity naturally limited by lack of hydrology to support year round flows in most drainages. • Stream channels & riparian conditions have been drastically altered by flood events & human activity. • Water temperatures may also be a factor negatively affecting salmonid productivity within the watersheds, given low flow conditions. Extent to which human activities may exacerbate this condition is unknown. • Ground water quality in Mansfield & Douglas Creek drainages are high in nitrates & coliform bacteria, relative to drinking water standards. In Mansfield there was no conclusive evidence as to the source of nitrate problem & nitrate concentration fluctuations (Johnson 1974). High nitrates around Douglas Creek are due to the high percentage of fertilized land & the low flows that do not dilute these levels until lower in the watershed (Isaacson 1989). • Some degree of soil erosion & sedimentation is occurring in Douglas Creek & tributaries & Upper & Lower Moses Coulee subwatersheds (Sagebrush Flats), lowering water quality within the watershed & the drainages downstream on to the Columbia River. • Difficult to identify the cause of soil erosion & sedimentation & draw conclusions between farming practices, on-site conservation practices, & water quality. • Although there are human impacts in the Moses Coulee Watershed, these impacts have a very limited affect on anadromous salmonid spawning & rearing use in the

WRIA	BASIN	LIMITING FACTORS
		watersheds. This is mostly a reflection of the natural limitation imposed on the habitat by the arid, shrub steppe ecosystem (TAG 10-30-00; TAG 11-21-00).
44	*Recommendations*	• Habitat restoration projects must be directed at the condition(s) causing the habitat degradation (causal mechanisms), not at its symptoms. • Structural manipulations of the stream channel (such as boulder or log placements) should not be used unless those causal mechanisms cannot be corrected within a reasonable time. • Conduct general presence/absence salmonid surveys on Moses Coulee, Sand Canyon Creek, Rock Island Creek & Douglas Creek. • Collect baseline data on known fish bearing streams for the following habitat parameters: fine sediment, temperature, & instream flows. • Research surface/ground water interactions & investigate the opportunity for augmenting low instream flows. • Install stream gauges to learn more about the instream flows. • Using historical information gathered from landowners, conduct analyses of changes over time of riparian, floodplain & wetlands acreage & conditions, & uplands vegetation cover types, as they affect watershed hydrology.
46	Entiat Watershed	• A lack of overwintering juvenile rearing habitat, due to losses in floodplain connectivity & riparian zone conditions, is the most limiting to the ability of the habitat in the watershed to fully sustain salmon populations. • Unscreened & inadequately screened surface water diversions (pumps & ditches) & improperly designed water diversions & dams pose a direct threat to salmonids.
46	*Recommendations*	• Secure protection of stream channel sections anywhere in the watershed that presently allow unrestricted stream channel diversity & floodplain function. • In order of priority, stream reaches which should receive protection: 1. Riparian bottom land & side channels in the Stillwaters Reach (between the terminal moraine & Preston Creek). 2. Riparian bottomland & side channels along the mainstem Entiat between Preston Creek & Fox Creek. 3. Riparian bottomlands in the lower Mad River, Stormy Creek & Roaring Creek. • Rehabilitate altered stream reaches to increase functional overwintering juvenile rearing habitat. ➢ Initial focus should be on structurally engineered & designed improvements like anchored large woody debris (LWD), boulder placement & side channel constructions. ➢ In the long term, secure riparian habitat in the watershed

WRIA	BASIN	LIMITING FACTORS
		downstream of the Mad River confluence.
48	Methow River Watershed	• Fish passage blocked between 1915-1929 by hydroelectric dam at Pateros. • 94% of the watershed is in public lands (Rock Island Hydroelectric Facility et al. 1998). • Decline attributed to passage problems & mortality associated with nine hydroelectric facilities on the mainstem Columbia River, unfavorable ocean conditions, harvest pressures, & degradation of ecological processes & habitat within the Methow watershed (WDFW et al. 1990; Peven, 1992; Caldwell & Catterson 1992; WDFW 1993; Williams et al. 1996). • The Methow River is a journey of 424 river miles from the mouth of the Columbia River & requires navigating through nine hydroelectric facilities once as smolts & again as adults. • Bull trout - speculation that the conversion of the free-flowing upper Columbia River to a series of reservoir impoundments has had a negative effect on upper Columbia River fluvial bull trout populations (Brown1992). • Human alterations primarily in the lower gradient, lower reaches of subwatersheds add to decline – including road construction & locations, conversion of riparian habitat to agriculture & residential development, water diversions, & diking.
48	*Recommendations*	• Protection of properly functioning habitat ➢ Top Priority - Floodplains & riparian habitat along the upper Methow River from the Lost River confluence, inclusive, downstream to the town of Winthrop ➢ Second Priority - Protecting functional floodplains & riparian habitat located in the lower 15 miles of the Twisp River & along the middle mainstem Methow River. • Restoration of fish passage & screening of water diversions. ➢ All water diversions on USFS land have been identified & are screened as per federal standards. • Restoration of stream functions in the lower 15 miles of the Twisp River. ➢ Next to habitat protection, fish barrier removal & screening issues, rehabilitating the stream functions in the lower 15 miles of the Twisp River was identified as a critical action needed to insure sustainability of naturally-producing, anadromous salmonids in the Methow watershed. ➢ Based on spring chinook spawning ground survey results from 1987 – 1999, 25% of spring chinook redds were found in the Twisp River. ➢ Lower Gold Creek & lower Lost River would benefit, to a much lesser extent, chinook, rainbow/steelhead & bull trout species. ➢ Rehabilitation of stream functions in the lower reaches of Wolf

WRIA	BASIN	LIMITING FACTORS
		Creek, the Chewuch River & Early Winters Creek also would benefit salmon, rainbow/steelhead & bull trout. Active restoration plans are in place for both the Chewuch & Early Winters, & a Habitat Conservation Plan is currently being negotiated for the Wolf Creek drainage. • Research, analyze & assess the relationship between stream flows & water use in the watershed. ➢ The extent to which environmental conditions or human influences contributes or causes low flows or dewatering in a given reach requires further data collection & analysis. • Development & implementation of water conservation practices.
48	Upper Methow River Subwatershed	• 156,160 acres • The most significant human-induced impacts in this subwatershed occur along the mainstem Methow River from the Lost River confluence downstream to the town of Winthrop. • Except fopr the lower 2/3 of the Goat Creek drainage, subwatershed above the valley floor is properly functiioning. • Every major tributary to the Methow River in subwatershed has been diked & channelized (Lost River, Early Winters Creek, Goat Creek, Wolf Creek). • LWD inadequate throughout subwatershed. • Goat Creek (RM 64.0) LWD levels have improved & are reaching “adequate” amounts. • Accelerated bank destabilization occurring due to conversion of riparian lands to residential & agricultural use. • Loss of fish production excerbated by natural dewatering of portions of the mainstem Methow River from Robinson Creek downstream to the Weeman bridge during low water years.
48	Lost River Subwatershed	• 107,538 acres. 95% of the subwatershed lies within the Pasayten Wilderness. • Human impacts restricted to the alluvial fan in the lower mile of the Lost River. Impacts include construction of roads, dikes & buildings associated with home developments, resulting in a confined channel, reduced pool quality & quantity & elimination of side channel habitat. • Some riparian habitat in the lower mile has been converted to residential development & pasture land. • LWD has been removed from the lower mile of the river for flood control & firewood gathering, although recruitment potential is good from the upper reaches of the watershed.
48	Early Winters Subwatershed	• 51,547 acres • Human impacts primarily restricted to the lower 2 miles of the subwatershed, including its alluvial fan. • Habitat conditions elsewhere in the subwatershed are in a relatively undisturbed or properly functioning condition. • The lower ½ mile has been riprapped & diked to keep the

WRIA	BASIN	LIMITING FACTORS
		channel in a stable location to accommodate Highway 20, the Early Winters Campground development, & to protect private property. • Confined floodplain has resulted in concentrated high flows causing channel incision & entrenchment, channel scour, destabilizing banks & flushing out of spawning gravel. • Levels of LWD in the first two miles are low & pool quality & quantity is poor. • Severe low flows persist in the lower 1.4 miles of the creek where there are also two water diversions.
48	Chewuch River Subwatershed	• 335,000 acres • The upper 50% of the subwatershed is in a properly functioning condition. • Human land-use impacts downstream of RM 25.0 within the tributaries & along the mainstem of the lower 25 miles of the Chewuch River. • In lower half of the subwatershed, chronic & catastrophic sediment delivery to streams (correlated to highly erodible soils exacerbated by impacts from high road densities, road placements, & grazing). • In lower half of the subwatershed, reduced levels of LWD resulting from stream cleanouts & a loss of mature riparian LWD recruitment material. • Channelization in the alluvial fans at Farewell, Lake, Twentymile, & Boulder creeks. • Removal of large trees in the riparian zone along the lower 25 miles of the Chewuch River & lower Lake Creek. • Decreased beaver activity over historic times. • Low flows in the lower 8 miles of the Chewuch River. • Three water diversions in lower Chewuch River (RM 9.0, RM 8.1 & RM 0.9). • Two water diversions in Eightmile Creek (both at RM 0.25) which enters the Chewuch River at RM 8.0.
48	Middle Methow River Subwatershed	• 162, 834 acres • Diking, the conversion of riparian areas to agriculture & residential uses, & LWD removal along the mainstem Methow River are the most significant human impacts in this subwatershed. • Confined floodplain has resulted in loss of side channel access & habitat complexity. • Beaver Creek drainage – numerous man-made fish passage barriers & unscreened water diversion. • 78 man-made fish passage barriers (includes both partial & full barriers) & 26 unscreened water diversions (includes both pump & gravity diversions). [WDFW - Gower & Espie 1999]
48	Twisp River Subwatershed	• 157,114 acres • The capability of the lower 15 miles of the Twisp River to provide productive salmonid habitat has been substantially

WRIA	BASIN	LIMITING FACTORS
		reduced (TAG 2000). • Reduced LWD levels, road placement, dike placement, bank hardening, & conversion of riparian areas to agriculture & residential uses. • From RM 4.0 to the mouth, the reduction of instream flows resulting from water diversions has reduced the quantity of rearing habitat & access to rearing habitat.
48	Lower Methow River Subwatershed	• 235,553 acres • There has been no survey or data collection on habitat conditions for the segment of the Methow River that falls within this subwatershed (RM 0.0 - 27.0).
48	Libby Creek & Gold Creek drainages	• Heavily managed for timber harvesting & livestock grazing & are heavily used areas for recreation in the Methow Valley Ranger District. • Roads placement & high road densities are having a major affect on aquatic habitat where roads parallel every major stream. • LWD levels, pool habitat, & sediment delivery are poor to fair. • Lower 2.9 miles of Libby Creek have been channelized. • Portions of the banks along the lower 3.5 miles of Gold Creek have been riprapped. • In years when water diversions exceed base flows during August & September, lower Libby Creek dewaters. • Portions of the lower 3 miles of Gold Creek also dewater during dry years.
50	Foster Watershed	• 219,639 acres • Salmon distribution & productivity naturally limited by lack of hydrology to support year round flows in most drainages. • Stream channels & riparian conditions have been drastically altered by flood events & human activity. • Water temperatures may also be a factor negatively affecting salmonid productivity within the watersheds, given low flow conditions. Extent to which human activities may exacerbate this condition is unknown. • Some degree of soil erosion & sedimentation is occurring in East Foster Creek, lowering water quality within the watershed & the drainages downstream on to the Columbia River. • Difficult to identify the cause of soil erosion & sedimentation & draw conclusions between farming practices, on-site conservation practices, & water quality. • Although there are human impacts in the Foster Watershed, these impacts have a very limited affect on anadromous salmonid spawning & rearing use in the watersheds. This is mostly a reflection of the natural limitation imposed on the habitat by the arid, shrub steppe ecosystem (TAG 10-30-00; TAG 11-21-00).

Table IV-8

WRIA	BASIN	LIMITING FACTORS
50	*Recommendations*	• Habitat restoration projects must be directed at the condition(s) causing the habitat degradation (causal mechanisms), not at its symptoms. • Structural manipulations of the stream channel (such as boulder or log placements) should not be used unless those causal mechanisms cannot be corrected within a reasonable time. • Conduct general presence/absence salmonid surveys on Foster Creek. • Collect baseline data on known fish bearing streams for the following habitat parameters: fine sediment, temperature, & instream flows. • Research surface/ground water interactions & investigate the opportunity for augmenting low instream flows. • Install stream gauges to learn more about the instream flows. • Using historical information gathered from landowners, conduct analyses of changes over time of riparian, floodplain & wetlands acreage & conditions, & uplands vegetation cover types, as they affect watershed hydrology.

Region 5 – Snake River Watersheds

Geographic Boundaries

The Snake River Watersheds include:

- Lower Snake – Asotin Watershed [HUC 17060103 and WRIA 35]
- Lower Grande Ronde Watershed [HUC 17060106 and WRIA 35]
- Lower Snake – Tucannon Watershed [HUC 17060107 and WRIA 35]
- Palouse Watershed [HUC 17060108 and WRIA 34]
- Rock Watershed [HUC 17060109 and WRIA 34]
- Lower Snake Watershed [HUC 17060110 and WRIA 33]
- Clearwater Watershed [HUC 17060306 and WRIA 34]

The watersheds stretch into Adams, Asotin, Columbia, Franklin, Garfield, Lincoln, Spokane, Walla Walla, and Whitman Counties.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species descriptions and the factors to their decline, see Appendix A.

Birds:

- Bald eagle (*Haliaeetus leucocephalus*) — Threatened

Fish:

- Columbia River bull trout (*Salvelinus confluentus)* — Threatened
- Snake River fall chinook (*Oncorhynchus tshawytscha*) — Threatened
  Designated critical habitat
- Snake River spring/summer chinook (*Oncorhynchus tshawytscha*) — Threatened
  Designated critical habitat
- Snake River sockeye (*Oncorhynchus nerka*) — Endangered
  Designated critical habitat
- Snake River steelhead (*Oncorhynchus mykiss*) — Threatened
  Designated critical habitat

Mammals:

- Canada lynx (*Lynx canadensis*) — Threatened
  [Blue Mountains]

Plants:

- Utes ladies'-tresses (*Spiranthes diluvialis)* — Threatened
- Spalding's silene (*Silene spaldingii)* — Threatened
  [Asotin, Lincoln and Spokane Counties only]
- Water howellia (*Howellia aquatilis)* — Threatened
  [Spokane County only]

Land Use Activities

Timber Harvest

Timber harvest activities in the Snake River watersheds occur in the Blue Mountains in and around the Umatilla National Forest. As shown in Table IV-9, waterbodies in this vicinity exceed state standards for temperature, sedimentation, and dissolved oxygen. These waterbody impairments are often associated with areas where the timber has been overharvested, high forest road densities exist, and riparian habitat has been removed.

Agricultural Production

Significant agricultural production occurs throughout the Snake River watersheds. Conversion of habitat to agricultural lands has resulted in loss of riparian habitat,

unstable stream banks with poor cattle exclusion devices, excessive chemical levels in the water associated with pesticides and herbicides, high water temperatures, low dissolved oxygen levels, high levels of fecal coliform, and low flow problems due to water withdrawals for irrigation (See Table IV-9).

Urban Development

The primary impact to the Snake River watersheds by urban development is the series of dams and hydropower plants along the Snake River. Four hydropower facilities exist on the mainstem Snake River. The creation of the dams have restricted stream flows, flooded wildlife habitat, and introduced chemicals associated with hydropower facilities and transformers into the water bodies (See Table IV-9).

The main populations in the region are centered in Walla Walla and Pullman – both relatively small metropolises in comparison to other portions of the State. Stormwater runoff and increased impervious surfaces are issues for these cities as well as others much larger. Outside of these major urban areas, the majority of residential development is on septic systems. Common water contaminants associated with urban development and residential septic systems include excessive water temperatures, lowered dissolved oxygen levels, fecal coliform, and chemicals associated with pesticides and urban runoff. Two ports exist within the region – Walla Walla (at the confluence of the Columbia and Snake Rivers) and Clarkston along the Snake River. These ports mainly transport agricultural products.

Protected areas

The following federally protected area occurs in the Middle and Upper Columbia River Watersheds: Umatilla National Forest (1.4 million acres).[87]

The Washington State protected Natural Area Preserves (NAP) occurring in the Snake River Watersheds includes Marcellus Shrub Steppe NAP (Adams County – 122 acres).

[87] Majority of the Umatilla National Forest is within Oregon State boundaries.

There are no designated Washington State Natural Resource Conservation Areas (NRCAs) in the Snake River Watersheds.

The following areas are designated Wildlife Areas and protected by Washington Department of Fish and Wildife: Asotin Wildlife Area (Asotin County – 13,815 acres), Chief Joseph Wildife Area (Walla Walla County – 9,735 acres), Esquatzel Coulee Wildlife Area (Franklin County – 1,732 acres), Grouse Flats Wildife Area (Garfield County – 640 acres), and William Wooter Wildlife Area (Columbia and Garfield Counties – 11,778 acres).

Private protected lands in the Snake River watersheds include: The Nature Conservancy – Rose Creek Preserve (Whitman County – 22 acres); Tapteal Greenway (Franklin County); and Wilderness Land Trust (Walla Walla County).

Impaired Waterbodies

All or portions of the waterbodies listed in Table IV-9 have been listed under Section 303(d) of the Clean Water as impaired waterways. The parameter(s) exceeded are noted for each waterbody. Full extents of the listed waterbodies may be obtained from Washington State Department of Ecology in the “Final 1998 Section 303(d) Listed Waterbodies for Washington State”, dated April 4, 2000.

Table IV-9: Section 303(d) Listed Waterbodies in Snake River Watersheds

Source: Final 1998 Section 303(d) List, Washington State Department of Ecology, April 4, 2000.

WRIA	WATERBODY NAME	PARAMETER EXCEEDED
33	SNAKE RIVER	Dissolved Oxygen, Temperature, Total Dissolved Gas
34	MEDICAL LAKE	Total Phosphorus
34	MISSOURI FLAT CREEK	Dissolved Oxygen, Fecal Coliform
34	PALOUSE RIVER	4,4'-DDE, Chromium, Dieldrin, Dissolved Oxygen, Fecal Coliform, Heptachlor Epoxide, PCB-1260, pH, Temperature
34	PALOUSE RIVER, S.F.	Dissolved Oxygen, Fecal Coliform, pH, Temperature
34	PARADISE CREEK	Ammonia-N, Dissolved Oxygen, Fecal Coliform, Temperature
34	PINE CREEK	Dissolved Oxygen, pH, Temperature
34	REBEL FLAT CREEK	Dissolved Oxygen, Fecal Coliform
34	ROCK CREEK	pH, Temperature
34	UNION FLAT CREEK	Temperature
35	ASOTIN CREEK	Fecal Coliform
35	PATAHA CREEK	Fecal Coliform
35	SNAKE RIVER	Temperature, Total Dissolved Gas
35	TUCANNON RIVER	Temperature

To date no WRIA Limiting Factors for Salmonid Species by Basin have been completed for the Snake River Watersheds**.** Source: Washington Conservation Commission (http://www.conserver.org/salmon/index.php3)

V. Cumulative Effects

A. Scope

In the context of the Endangered Species Act (ESA), cumulative effects encompass the effects of future State, tribal, local or private actions that are reasonably certain to occur in the covered area; in this case, the entire state of Washington. Future Federal actions, including those that are unrelated to the proposed action, are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Cumulative effects, in the context of Section 7 consultation, are generic to the area of consideration and, other than temporally, not related to the Federal action. The cumulative effects analysis is therefore independent of the specific habitat rehabilitation/restoration activities (or any other Federal action, for that matter) addressed in this programmatic biological evaluation. Future Federal actions, including future Corps regulatory actions, will be addressed via future individual or programmatic Section 7 consultations.

In general, we expect that activities covered by this programmatic biological evaluation will cluster along waterways and shorelines throughout the state, but may be widely scattered across the landscape. Non-Federal actions occurring concurrently with the covered activities will be similarly distributed across the state. This cumulative effects analysis addresses impacts in the context of general trends in population and land-use within Washington State.

B. Population

Washington's current population of about 5.8 million people has increased by about 1 million since 1990. Based on 2000 Census data, recent population growth, on a percentage basis, has been greatest in Clark (45% increase since 1990), San Juan (40 % increase), and Grant (37% increase) Counties. King, Pierce, Snohomish, and Clark Counties each gained more than 100,000 people in the 1990s. Population densities in the state are highest in the lowland areas surrounding the Puget Sound, the Yakima River valley, Clark and Cowlitz County areas along the Columbia River, the Spokane area, the I-5 corridor in Lewis County, and the northern edge of the Olympic peninsula. Statewide, average population density is about 89 people per square mile (ranging from 817 people/square mile in King County to 3.4 people/square mile in Garfield County).

Forecasts for population growth predict an additional 1.2 to 2.5 million people residing in Washington by 2020.[88] In the shorter term, between 6 and 6.5 million are predicted to

[88] OFM, 1999.

call Washington home by 2005. Future growth patterns should mirror historical patterns, with most growth in the Puget Sound area, along the I-5 corridor, and in selected valleys and highway corridors in eastern Washington.

C. Residential, Commercial, and Infrastructure Development

Intuitively, population growth results in increasing residential and commercial development.[89] Improvements and upgrades to infrastructure (including highways, other transportation facilities, pipelines, power lines, and power plants) will likely track closely with increased residential and commercial development. Primary pathways of potential effects of land development include direct habitat loss, decreased water quality, contamination of waterways and uplands, changes to runoff patterns, habitat fragmentation, isolation of populations, and loss of habitat diversity. In general, as development increases the quantity and quality of habitat suitable for threatened and endangered species typically decreases. Based on past trends and types of development, future residential, commercial, and infrastructure development will likely lead to further habitat degradation. Actions taken to mitigate for the potential impacts of development may help slow the rate of habitat degradation.

D. Agriculture

Trends in agricultural lands are dependent upon a wide variety of factors. The acreage of agricultural land in Washington has remained essentially constant since 1945.[90] Types of agricultural activities vary over time based on availability of water, crop markets, and technological innovation. In eastern Washington, federal management of the Columbia River system (itself subject to Section 7 consultation) determines, to a large extent, the price and availability of water for agricultural production.

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[89] Recent trends in shoreline permits issued throughout the state do not correspond with the observed increase in population. In 1997 and 1998, total of 799 and 838 shoreline permits, respectively, were issued or denied statewide (OFM, 1999), the two lowest totals since 1979 (the earliest year for which data was obtained). The observed trend may reflect trends in shoreline development or changes in the Shoreline Management Act.

[90] OFM, 1999.

Assuming future trends mirror the historical pattern, substantial additional impacts to fish and wildlife due to agriculture are not expected. However, in many areas of the state, certain ongoing agricultural practices (such as irrigation, chemical application, and regular habitat disturbance in agricultural areas) are likely to prevent habitat from reaching properly functioning conditions for listed species.

E. Fisheries

Fishing activities result in direct take of listed fish species and decreased forage base for other listed mammal and bird species. In Washington, salmon catches have steadily declined since the early 1970's.[91] For example, in 1975, about 1.3 million pounds of chinook salmon were caught by commercial, tribal, and sport fisheries. In 1995, the total weight of the chinook salmon catch was about 240,000 pounds. Other fish stocks have also experienced substantial population declines. Herring stocks in Puget Sound have decreased from a high of about 25,000 tons in 1979 to less than 10,000 tons in 1999.[92] Rockfish stocks have decreased by 75 percent from peak spawning levels in the 1970s.[93] Lingcod populations in the northern Puget Sound and the Strait of Georgia are estimated at approximately 2 percent of that in 1950.[94] Imperiled fish populations have led to decreased fishing pressure. For example, the number of licensed commercial fishing boats in Washington has steadily decreased from 7,889 vessels in 1980 to 2,494 vessels in 1998.[95]

Even if fish catches level off, impacts to listed species, particularly listed salmonids, from fishing activities are expected to continue. Catch targeted on fish produced at hatcheries inevitably results in some bycatch of co-occurring wild fish, including wild fish that are now listed as threatened or endangered. Even catch-and-release fisheries may cause lethal or sub-lethal adverse effects to listed fish. Harvest of forage species may imperil other listed species. Assuming that fisheries continue to catch listed species or their forage base, adverse effects of such harvest will continue.

[91] DNR, 2000.
[92] DNR, 2000.
[93] DNR, 2000.
[94] DNR, 2000.
[95] DNR, 2000.

F. Forestry

Timber harvest in Washington State in the 90's is lower than any period since the late 1970's.[96] Concentrated mainly in western Washington, an annual total of just over 4 billion board feet was produced by Washington forests from 1993-96, compared with a high of slightly more than 7 billion board feet in each 1987 and 1988.[97] Of the total timber harvest, between 75 and 90 percent of the harvest is produced from non-federal lands for any given year. Taking just non-federal lands into consideration, timber harvest has fluctuated fairly tightly around an average of about 4.6 billion board feet.

In Washington, timber harvest typically involves clear-cutting techniques. Impacts due to clear-cutting and forest roads have been well documented.[98] Clear-cutting impacts are long lasting and additive. Although the rate of harvest appears to be slowing and improved best forestry practices have been implemented, the collective impacts of past and reasonably foreseeable future forestry activities are likely to result in additional future degradation of habitat for listed species.

G. Pollutant Discharge

Air and water pollution can degrade habitat and have lethal and sub-lethal effects on fish and wildlife. Increased population typically causes increased air and water pollution. Developed areas also generate effluent and runoff is often polluted with a variety of substances. In the early 1990's, Washington led the nation in the weight of pollutants discharged directly to surface waters.[99] As of 1999, nearly 60 percent of the lakes, steams, and estuaries for which there is date fail to meet water quality standards.[100] Extremely high concentrations of polychlorinated biphenyls (PCBs) in the blubber of orca whales in Puget Sound make them among the most contaminated

[96] OFM, 1999.
[97] OFM, 1999.
[98] Beechie, et al., 1997; Kiffney et al., in review; Pess et al., 1999
[99] DNR, 2000.
[100] DNR, 2000.

marine mammals on earth.[101] Clearly, pollutants loads in Washington waters have reached levels of concern.

Ongoing State cleanup activities will help to mitigate the more acute pollutant sinks and sources in some parts of the state (Federal cleanup activities are intentionally excluded from the ESA cumulative effects analysis). While it is difficult to estimate future trends in pollutant discharge, discharges will likely continue in the future and are very likely to degrade habitat for listed species.

H. Other Activities

Other non-Federal activities (recreation, poaching, waste disposal, etc.) also have the potential to affect listed species in the future. Taken individually, any given activity may have an inconsequential effect on listed species. However, when viewed as a whole and in the context of past trends, we predict continued degradation of the status of listed species and their habitats.

Our analysis is based on extrapolation of past trends into the future. Recent concern about declining populations of salmonids in Washington State has fostered efforts to change past trends. The State of Washington is actively pursuing recovery of salmonid stocks via a comprehensive program of habitat protection, education, policy analysis and modification, and public outreach. The efforts of Washington State, along with initiatives by private and local entities, may help reverse some of the trends discussed above.

I. Conclusion

The ESA listings of a variety of fish and wildlife species in the State of Washington have been based, in part, on the additive impacts of growth, development, and other human activities. At this point, the trends discussed above indicate that future impacts will progress similarly, leading to additional adverse impacts on all fish and wildlife and their

[101] DNR, 2000.

habitats. Changes to past development practices provide hope that past trends are not predictive of the future circumstances.

VI. Chapter 1 - Activity Descriptions, Conservation Measures, and Effects Analyses - Removal of Fish Passage Barriers

Background

Salmonids exploit a variety of types of freshwater habitat during different parts of their life cycle. Access to suitable freshwater habitat is crucial to the continued existence of all salmonids. Past construction practices have resulted in stream crossings of many types that block fish passage to both up and downstream areas. In most cases, blockages pose more acute problems to fish attempting to migrate upstream. By preventing access to upstream areas, fish passage barriers can prevent access to juvenile summer and winter rearing areas and adult spawning areas. Fish passage barriers compromise safe passage conditions that are essential to successful rearing and spawning, particularly for salmonid stocks with small population sizes (50 CFR 226).

Complete passage barriers block the use of the upper watershed, often the most productive spawning habitat in the watershed considering channel size and substrate. Access to upper portions of the watershed is important; fry produced there then have access to the entire downstream watershed for rearing. *Temporal passage barriers* block migration some of the time and may result in loss of production by delay (anadromous salmonids survive a limited amount of time in fresh water and a delay can cause mortality or limit distribution). *Partial passage barriers* block smaller or weaker fish of a population and limit the genetic diversity that is essential for a robust population. Fish passage criteria accommodate weaker individuals of target species including, in some cases, juvenile fish (from WDFW, 1999).

Purpose

Removal of fish passage barriers accomplishes several objectives:

- Improve fish passage, facilitate natural sediment and wood movement, prevent roadbed erosion, and prevent erosion or aggradation of the streambed in the vicinity of the crossing;

- Eliminate or reduce constraints that cause changes in stream flow patterns that that lead to undermining of roadbeds and culvert washouts.

Covered Activities

A variety of circumstances can prevent fish passage to historically accessible parts of a given watershed. Activities designed to restore fish passage above hydroelectric dams, flood control dams, natural waterfalls, or naturally impassible cascades are not covered by this programmatic consultation. Covered activities include removal of fish passage barriers caused by:

- Stream crossings by roads, levees, dikes, or similar features;
- Tide gates;
- Certain types of debris jams;
- Certain types of sediment bars and flood terraces.

Activities covered by this evaluation replace impassible structures with a more passable structure or remove barriers entirely to restore fish passage for at least 90% of the flow conditions experienced during migration season for listed and proposed fish species at the structure location. Since migration timings vary among species and watersheds, knowledge of specific migration timing is necessary for determination of the fish passage design flow.

The high flow design discharge for fish passage shall be the 10% exceedance flow (at least 90% of the flow conditions are lower than the 10% exceedance flow). Where streamflow data is not available for the subject stream, the 10% exceedance flow may be determined by extrapolating data from a hydrologically similar basin or by using an appropriate model (refer to Powers and Saunders, 1998). Otherwise, the two-year peak flood flow may be used as a surrogate for the 10% exceedance flow. At flows higher than the fish passage design flow, natural flow conditions in the watercourse would likely preclude upstream movement of target species, even in the absence of modifications to the stream corridor. The design of the structure must satisfy this

criterion for the target species and age class (generally both adult and juvenile fish except where site-specific conditions would preclude upstream passage for juvenile fish even in the absence of the structure).

New structures must also be designed to maintain sufficient water depth to allow fish passage during low flow periods of the migration season. The low flow design discharge for gauged streams shall be the 95% exceedance flow or the two-year seven-day low flow discharge (WAC 220-110-070). Where streamflow data for the subject stream is not available, the 95% exceedance flow may be determined by extrapolating data from a hydrologically similar basin or by using an appropriate model.

Where culverts are placed on a flat gradient, embedded 20% of the culvert diameter or vertical rise (where arch culverts are used, footings must be buried such that they cannot be exposed by scour), and as wide or wider than the average channel bed width of the stream, the minimum water depth within the crossing shall be at least equal to the depth of the natural channel in the absence of the crossing (as extrapolated by the upstream and downstream channel characteristics) [WAC 220-110-070(3)(b)(i)].

Where culverts are not placed on a flat gradient, sufficiently embedded, or not as wide as the average channel bed width of the stream, the low flow design discharge shall be used to determine the depth of water in the new structure during low flow periods. During migration season at the structure location and for the target life history stage of listed and proposed fish species, water depth shall be no less than 1 foot within the thalweg of the channel within a new structure [WAC 220-110-070(3)(b)(ii)(A)].

a. Stream Crossings by Roads, Levees, Dikes, or Similar Features

Inadequately designed, poorly maintained, or improperly installed culverts are one of the most common types of structures that block fish passage. Culverts are usually uniform and efficient to optimize water passage; they often do not have the roughness and variability of stream channels and therefore do not dissipate energy as readily. The concentration and dissipation of energy in the form of increased velocity, turbulence or downstream channel scour are the most prevalent blockages at culverts (WDFW,

1999). There are five common conditions at culverts that create migration barriers (WDFW, 1999):

- Excess drop at culvert outlet;
- High velocity within culvert barrel;
- Inadequate water depth within culvert barrel;
- Turbulence within the culvert;
- Debris accumulation at culvert inlet or inside the culvert.

Culverts are a rigid boundary set into a dynamic stream environment. As the natural stream channel changes, in response to changes in hydrology due to land use changes, culverts often are not able to accommodate those changes and barriers are created (WDFW, 1999).

Passage barriers at culverts are the result of improper design or installation, or subsequent changes to the channel. They are very often the result of degrading channels that leave the culvert perched above the downstream channel. Changes in hydrology due to urbanization are a primary reason for degrading channels. Barriers are also caused by scour pool development at the culvert outlet. The scour pool may be good habitat in itself but it moves the backwater control of the downstream channel further downstream and therefore to a lower elevation creating a drop at the outlet. The presence of large scour pools and/or upstream mid-channel bars are often an indicator that a velocity barrier exists within the culvert at high flows (WDFW, 1999).

Many fish passage barriers at culverts that occur at high stream flows are not apparent during the low and normal stream flows. Culverts must be analyzed at both the low and high fish passage design flows (WDFW, 1999).

Selection of the type and placement of the new structure depends on stream size, energy, morphology, and fish use. Possible options to remove structural barriers to fish passage (in order of descending preference) follow:

- Culvert removal;
- Full span bridge or arch culvert;
- Bottomless culvert;
- Countersunk pipe or box culvert.

Recent experience in Western Washington has shown that about 5% of barrier remedies require replacement of an existing culvert with a bridge, or abandonment of the road (WDFW, 1999). Where the width of the stream crossing exceeds 100 feet (Furniss, *et al.*, 1991) or where the difference in stream grade between the inlet and outlet of the existing structure results in a gradient in excess of 5% then a bridge should be strongly considered.

Upon completion, projects will provide a native bed structure and full stream width. Design of any structure will apply the principals expressed in the Washington State Department of Fish and Wildlife design manual for fish passage at road crossings (WDFW, 1999).

i. This programmatic biological evaluation covers the following categories of activities associated with restoration or rehabilitation of fish passage at existing stream crossings:

    - Replacement of culverts or bridges;
    - Modification of impassible culverts;
    - Construction of fish passage weirs, directly related to replacement, modification, or removal of stream crossings;
    - Construction of bed control structures, keyed into the streambank, directly related to replacement, modification, or removal of stream crossings;
    - Streambed grading directly related to replacement, modification, or removal of stream crossings;
    - Placement of streambed substrate and woody debris directly related to removal, replacement, or modification of stream crossings;

- Installation of bank protection on the roadway fill prism directly related to replacement, modification, or removal of stream crossings; and
- Streambank and riparian grading and planting directly related to removal, replacement, or modification of stream crossings.

ii. This programmatic biological evaluation **does not cover** the following categories of activities of work at or near existing stream crossings:

- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques (this restriction does not apply to protection of the fill prism of a road or work required to key bed control structures into the streambank; see above);
- Culvert or bridge replacement or modification activities that do not provide or facilitate fish passage;
- Construction of new stream crossings;
- Replacement of culverts or bridges that are part of larger development projects (i.e. the removal of the fish passage barrier does not have independent utility from other related work);
- Other activities at stream crossings not associated with restoration or rehabilitation of fish passage.

b. Tide Gates

Tide gates are structures attached to culverts through levees or other types of berms flowing into tidal waterbodies for the purpose of controlling tidal inundation. In some instances, gates may be installed in non-tidal areas to prevent flooding during high flow events. Typically, tide gates consist of a flap hinged to the culvert outlet.

In Washington State, tide gates are typically attached to the culvert outlet. In this configuration, a properly installed tide gate will allow water to flow out from the tributary or wetland when the elevation of the water in the receiving waterbody is lower than the outlet elevation of the culvert. When the elevation of the water in the receiving waterbody is higher than the culvert outlet, the flap of the tide gate closes and prevents backflow of water into the tributary or wetland. If attached to the culvert inlet, a tide gate can also be used to impound water on the upstream side of a levee or berm.

Historically, tide gates have been very effective at draining tidal marshes. At the same time, tide gates have cut off fish access to the many areas behind levees or berms. Fish passage through tide gates can be further hindered by damaged or inadequately maintained tide gates.

Tide gates may hinder or prevent fish access to tributaries or wetlands that could be used for spawning and/or rearing habitat. At the mouths of river systems, tide gates can prevent juvenile salmonids from accessing marsh habitat that the fish historically used for feeding while gradually adapting from the freshwater to the marine environment.

Fish passage can be restored through complete removal of the tide gate or replacement or modification of impassible tide gates with more passable designs. Self-regulating tide gates, a mechanical design where the opening and closing of the gate is controlled by a float system, can restore fish passage and tidal flushing to upstream areas while still maintaining flood control and drainage functions. Depending on the float setting, self-regulating tide gates can be set to close with every daily high tide or only during extreme flood events. In some circumstances, other types of tide gates, with hydraulic or electrical controls, can be used to facilitate fish passage.

In some cases, restoration of fish passage requires tide gate replacement or removal concurrently with, according to the culvert specifications discussed above, replacement of its associated culvert.

i. This programmatic biological evaluation covers the following categories of activities associated with restoration or rehabilitation of fish passage at existing tide gates:

    - Replacement of tide gates or the connected culverts;
    - Modification of tide gates or the connected culverts;
    - Removal of tide gates or the connected culverts; and
    - Streambank grading and riparian planting directly related to removal, replacement, modification, or removal of tide-gates or the connected culverts.

ii. This programmatic biological evaluation **does not cover** the following categories of activities of work at or near existing tide gates:

- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques;
- Tide gate replacement or modification activities that do not provide or facilitate fish passage;
- Installation of new tide gates; and
- Other activities at existing tide gates that are not associated with restoration or rehabilitation of fish passage.

c. Debris Jams

Jams of large woody debris (LWD) play a critical role in creating and maintaining fish habitat in streams and rivers (National Research Council, 1996). In-stream LWD helps create pools, increase habitat complexity, reduce sediment transport, trap gravel needed for spawning, stabilize stream channels, provide food for aquatic invertebrates, and provide stream nutrients (Bisson *et al.*, 1987).

Notwithstanding the benefits of large woody debris in streams, improper disposal of garbage, landscape waste (i.e. grass clippings), construction waste (i.e. lumber, shingles, bricks), or industrial debris (i.e. pallets, construction materials) can accumulate in streams in locations and configurations that block fish passage. In many cases, the debris itself is the barrier to fish passage. Additionally, hydraulic changes caused by improper debris disposal can create blockages in the immediate vicinity of such debris jams. Fish passage can be restored by removal of the debris from the stream and restoration of stream gradient in the vicinity of the debris jam.

i. This programmatic biological evaluation covers the following categories of activities associated with restoration or rehabilitation of fish passage at certain types of debris jams:

   - Complete removal of garbage, landscape waste, construction waste and debris, or industrial debris from stream channels;
   - Use of mechanized equipment from upland areas provided that new access roads or clearing of woody vegetation are not required;
   - Streambed grading directly related to debris jam removal within 50 feet of the debris jam removal site; and

- Streambank grading and riparian planting directly related to debris jam removal within 50 feet of the debris jam removal site.

ii. This programmatic biological evaluation **does not cover** the following categories of activities associated with restoration or rehabilitation of fish passage at certain types of debris jams:

- Removal of naturally occurring woody debris from any waterbody;
- Removal of beaver dams;
- Construction of new temporary or permanent roads or clearing of woody vegetation to access the work area;
- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques;
- Partial removal of a debris jam composed of garbage, landscape waste, construction waste, or industrial debris; and
- Other activities at debris jams that are not associated with restoration or rehabilitation of fish passage.

d. Sediment Bars or Terraces[102]

Many agricultural and urban land uses generate an increase in sediment entering the receiving stream. Discrete mass wasting events can also temporarily elevate the sediment bedload of a stream. In some instances, this sediment can accumulate at the stream mouth, forming a bar or terrace. The bar or terrace can spread the streamflow into a finely braided or sheetflow pattern, thereby forming a temporal or complete barrier to fish passage.

Fish passage can be restored or rehabilitated by removal of the sediment bar or terrace at the mouth of a stream. In most instances, the sediment bar or terrace is a symptom of poor land use practices and removal of it is a short-term solution. To permanently restore fish passage, changes in land use practices are necessary. Nevertheless, the benefits accruing from restoring or rehabilitating fish access to upstream spawning and

[102] Under certain circumstances, emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainageways may be exempt from Department of the Army permit requirements [33 CFR 323.4(a)(1)(iii)(C)(*1*)(*iv*)]. Exempt activities do not require ESA consultation through the Corps Regulatory program.

rearing habitat, even temporarily, likely outweigh the adverse impacts resulting from such actions.

In addition to direct removal of the sediment bar or terrace, sandbags can be installed in selected watercourses in a manner to effect sufficient water depth and flow characteristics to allow for the migration of fishes of concern. Sandbags can be used in some instances to concentrate flow at shallow, impassible riffles to form a deeper, focused, thalweg. They may also be used to direct flow to isolated refuge habitats of fishes of concern (e.g., disconnected pools) or to create dammed step pools to allow fishes of concern to ascend transient migration barriers. For the purposes of this action, fishes of concern are resident and anadromous salmonids.

i. This programmatic biological evaluation covers the following categories of activities associated with restoration or rehabilitation of fish passage at sediment bars or terraces:

   - Removal of up to 25 cubic yards of sediment from within 50 feet of the mouth of a stream;
   - Temporary use of sandbags to restore fish passage or maintain fish life during periods of extremely low flows;
   - Use of mechanized equipment from upland areas provided that new access roads or clearing of woody vegetation are not required;
   - Streambed grading directly related to removal of sediment bars or terraces within 50 feet of the mouth of a stream; and
   - Streambank grading and riparian planting directly related to removal of sediment bars or terraces within 50 feet of the work site.

ii. This programmatic biological evaluation **does not cover** the following categories of activities of work at or near sediment bars or terraces:

   - Removal of more than 25 cubic yards of sediment from the mouth of a stream;
   - Removal of any sediment further than 50 feet of the mouth of a stream;
   - Removal of naturally occurring woody debris from any waterbody;
   - Removal of beaver dams;

- Construction of new temporary or permanent roads or clearing of woody vegetation to access the work area;
- Permanent use of sandbags to restore fish passage or maintain fish life.
- Use of sandbags for any other purpose other than restoration of fish passage or maintenance of fish life.
- Streambank hardening or channelization using rock, concrete, bulkheads, groins, J-vanes, bendway weirs, or other similar structures or techniques;
- Other activities at sediment bars or terraces not associated with restoration or rehabilitation of fish passage.

Activity History

Corps and Washington Department of Fish and Wildlife (WDFW) databases provided an estimate of the number of projects that have been authorized since 1996.

The Corps database provides the numbers of times that we have authorized wetland or stream restoration projects via Nationwide Permit 27 (see Table VI-1). Nationwide Permit 27 includes a wide variety of habitat enhancement projects, not only projects that restore fish passage, and the reported numbers therefore are conservative estimates of the numbers of activities that occurred that restored fish passage.

Table VI-1. Historical Record of Corps Verification of NWP 27 (Stream and Wetland Restoration Activities)

YEAR	1996	1997	1998	1999	2000
No. of NWP 27 Authorizations	10	54	94	60	53

In an effort to more completely represent the numbers of recent history for activities to restore fish passage, we reviewed the WDFW database on its Hydraulic Project Approval program (see Table VI-2). Starting in 1998, WDFW tracked activities by type (removal, enlargement, modification, repair, replacement) and category (bridge, culvert, tide gate). Table VI-2 summarizes the WDFW data.

The WDFW database identifies modification, removal, or replacement of tide or flap gates as a work type; no activities in this category were recorded in 1998, 1999, or 2000. WDFW database did not distinguish activities to restore fish passage that involved removal of certain types of debris jams, sediment bars, or flood terraces.

Table VI-2. Historical Record of WDFW Database for Removal of Fish Passage Barriers

	Stream Crossings
Removal	
1998	57
1999	33
2000	22
Retrofit/ Modification	
1998	106
1999	83
2000	56
Replacement	
1998	230
1999	160
2000	145

In light of the recent listings of various salmonids under ESA, local, State, Tribal, and Federal initiatives provide funding for projects that restore fish passage. Municipalities and private landowners have taken steps to restore fish passage on both private and public lands. We believe that the numbers of submitted applications proposing to restore fish passage will increase in the future.

Construction Description

Projects designed to remove fish passage barriers are typically implemented or constructed based on the following reference or analog design standards and methods. The standards and methods may change based on site-specific conditions.

a. Equipment Used

Equipment used for all of the projects would typically consist of a mix of the following: track hoe, back hoe, small bulldozer, tractor, grader, dump truck, front-end loader, concrete pumper truck, paving machine, pile driver, helicopter, pumps, hydraulic hammers, hydroseeding truck, and hand shovels and rakes. Diversion of streamflow around the work area would be accomplished with temporary cofferdams made of sandbags, ecology blocks, an aqua barrier (a manufactured vinyl tube filled with water), a Portadam® (a steel support system and impervious fabric membrane), or sheet piling; a full conveyance pipe (either a pipe or a hose large enough to accommodate expected high flows during the construction period); and suction pumps where gravity feed through the bypass is not possible (with inlets screened to prevent fish entrainment). Pumps would also be used to remove any water seeping into the work area either through or around the cofferdam. Erosion and sediment control equipment would consist of baker tanks, silt fences, hay bales, coir fabric or silt mats, plastic sheeting, and mulch.

b. Site Preparation

Erosion and sediment control equipment would be installed to prevent sediment from entering the stream during subsequent construction activities. The work area would then be isolated by nets, fish removed [see Conservation Measure (o)], the cofferdams installed, and flow diverted around the work zone [see Conservation Measure (n)]. Equipment staging would be located in specified areas away from wetlands or streams [see Conservation Measure (m)]. Access points and construction limits would be identified and stabilized [see Conservation Measure (m)].

c. Stream Crossings by Roads, Levees, Dikes, or Similar Features

Construction techniques for removal of fish passage barriers at stream crossings by roads, levees, dikes, or similar features are described below.

i. *Excavation of the Existing Culvert*: With the work area isolated, excavation of the existing culvert would commence. Excavating equipment would typically work from the road fill and excavated material would be stored nearby [subject to erosion

controls - Conservation Measure (s)] to be used as backfill later or hauled to an upland disposal location. Excavation of the fill prism would continue until sufficiently sized for the replacement structure or, in the case of road abandonment, at least as wide as the bankfull width of the waterway. Care must be taken during excavation to avoid exposing permeable layers (such as a gravel lens in an alluvial fan) that may allow the stream to flow underground. Unless used as the temporary flow bypass, the existing culvert would be removed prior to construction of the new structure. Where permeable layers present a risk of subsurface flow, an impervious material (such as bentonite) would be placed along the bottom of the excavated zone once excavation is complete. During excavation, groundwater would be removed from the work area by pumping to a treatment area prior to discharge back to any waterbody or wetland. If available, water removed from the work area may be discharged through the sanitary sewer. For projects involving removal of the stream crossing, restoration of the streambed and riparian area complete work at the project site (see below).

ii. *Installation of New Structure*:

1) Bridge: For pile-supported bridges, piling would be driven at the edge of each of the proposed approaches. In some instances, a footing would be cast at the edge of each of the proposed approaches to support the bridge. Otherwise, pre-cast concrete footings would be placed. Wingwalls may be constructed to protect the road fill prism. Fill would then be placed in lifts or layers (ranging in thickness from 4 inches to 2 feet per layer) to restore the roadway fill prism (WDOT, 2000). The bridge deck would then be constructed, followed by paving and final finish work on the roadway.

2) Bottomless or Arch Culvert: A footing would be cast or placed at the edge of each of the proposed approaches to the crossing. The arch culvert would be anchored to the footings and wingwalls may be constructed to protect the road fill prism. Fill would then be placed in lifts or layers to restore the roadway fill prism. Guidelines for lift thickness are given in culvert specification books (WDOT, 2000; Robison *et al*, 1999). Each lift should be compacted prior to placement of the next

lift. The stable bed and compacted lifts help prevent settling of the culvert and stabilize the culvert to prevent it from failing under vehicle loads. Paving and final finish work on the roadway would be accomplished.

3) Replacement Pipe or Box Culvert: Following excavation of the roadway fill, a bed of gravel would be placed and compacted. The replacement culvert would then be placed on the gravel bed, followed by placement of fill around it in successive layers or lifts. The culvert would be embedded or sunk below the final streambed elevation a minimum of 20% of the culvert diameter or vertical rise (in the case of an elliptical culvert; WDFW, 1999; WAC 220-110-070). [Culvert capacity for flood design flow shall be determined by using the remaining capacity of the culvert.] Guidelines for lift thickness are given in culvert specification books (WDOT, 2000; Robison *et al*, 1999). Each lift should be compacted prior to placement of the next lift. The stable bed and compacted lifts help prevent settling of the culvert and stabilize the culvert to prevent it from failing under vehicle loads. Wingwalls may be constructed to protect the road fill prism. Once the roadway fill prism is restored, paving and final finish work on the roadway would be accomplished.

iii. *Construction of Streambed Controls*: In some circumstances, it may be necessary to install bands of rock, wood, or concrete across the streambed to prevent or control scouring or headcutting in the vicinity of the stream crossing. These streambed controls are particularly important for embedded culverts designed with a roughened channel or streambed simulation. Under these circumstances, the streambed inside the culvert is necessary to provide passage of the target species. While it is expected that the bed material will shift slightly when exposed to streamflow, the substrate must not move any appreciable distance or leave the culvert (WDFW, 1999). Unlike weirs, streambed controls are intended to remain buried, providing a fixed point in the streambed to retard bed degradation.

Culverts with slope of less than 0.5% may not need substrate placed to simulate a natural streambed to achieve the fish passage design flow (Robison *et al*, 1999). In many cases, a no-slope culvert will provide passage for all species and life history

stages of fish, as long as it is placed in a manner that avoids high velocity flows or an elevation drop at the culvert inlet or outlet caused by scouring and deposition.

Streambed controls inside a culvert would typically be constructed by hand (in smaller culverts) or with small trackhoes (in larger culverts). Boulders, logs, or low concrete walls can be used to provide bands within the culvert that would anchor the smaller streambed material. The controls would be placed in bands within the culvert and buried by material selected based observations of the native streambed material and hydraulic analysis [see Conservation Measure (h)]. The embedded depth of the culvert would be based on the type of culvert, the stream gradient, the culvert gradient, and hydraulic analysis to achieve the fish passage design flow.

Streambed controls upstream and downstream of the culvert would be constructed by excavating a shallow trench, placing bands of boulders or logs, followed by backfilling with the native streambed material to bury the bed controls. Rock or boulder bands that extend above the surrounding streambed would be classified as weirs, not streambed controls.

Construction of all streambed controls would be accomplished before streamflow is re-introduced to the work area.

iv. *Construction of Weirs*: Weirs may be required in unusual situations to achieve the fish passage design flow on steep streams (gradients up to 12%) or existing culverts that have substantial elevation drop at the inlet or outlet. Where the difference in stream grade between the inlet and outlet of the existing structure results in a gradient in excess of 5% then a bridge should be strongly considered and would generally be preferred over construction of weirs. Weirs must be carefully designed and constructed to be effective.

Weirs can be installed upstream or downstream of the replacement culvert, or actually within the culvert and create a series of pools designed to decrease average velocity while providing depth to increase the ability of fish to pass over each weir.

Weirs can be constructed of logs, boulders, metal plates (inside the culvert), or concrete. Weir construction with logs and boulders is typically the same as construction of streambed controls but the log or boulder band would extend above the streambed.

Concrete weirs or fish ladders may be cast-in-place or pre-cast, requiring excavation for a footing, placement of shaped forms, pouring of concrete supplied with a concrete pumper truck or by hand, and removal of forms. No uncured concrete would come into contact with surface waters [see Conservation Measure (r)].

Metal plates used as weirs in culverts would either be pre-installed, bolted to the culvert walls, or welded to the metal pipe.

Following weir construction, streambed material would be placed to the depth specified by hydraulic analysis to provide the fish passage design flow. To prevent erosion from scouring around the weir, the weir would be keyed into the streambank with rock. Rock would be placed only at the weir ends, not the entire length of the streambank. Trackhoes would be required for the excavation and to move larger rock into place.

Construction of all weirs would be accomplished before streamflow is re-introduced to the work area.

d. Tide Gates

Removal of fish passage barriers at tide gates involves removal of the impassible tide gate and, if necessary, the connected culvert. Culvert removal and replacement would typically proceed as described in paragraphs 4(c)(i) and 4(c)(ii)(*3*) above.

Tide gate replacement involves removal of the existing tide gate with hand and power tools. The tide gate structure would be physically removed by hand or, if the tide gate is large, with a crane, backhoe, or other heavy equipment working from land or barge.

Prior to installation of the new tide gate, hardware may be welded or bolted to the end of the culvert. After installation of compatible hardware, the new tide gate would be moved

into place by hand or, for larger tide gates, with heavy equipment operating from land or barge. The tide gate would then be attached to the culvert and adjusted, as necessary, to allow water exchange and fish passage.

For projects that remove the tide gate but retain the existing culvert, the work would occur during low tidal stages. De-watering of the work area may not be necessary if the work consists solely of removing or replacing the existing tide gate at the end of a functioning culvert such that no soil would be disturbed.

e. Debris Jams

Removal of fish passage barriers created by debris jams consisting of garbage, landscape waste, construction waste and debris, or industrial debris typically requires access for excavation and hauling equipment, excavation/removal of the debris jam, and restoration of the streambed and riparian area. Provided that no new access roads are required and the equipment works from the streambank, excavation or debris removal would typically be done with a small trackhoe or backhoe and material would be removed from the riparian area with dumptrucks. If existing roads do not allow equipment to access the project site, work would be accomplished manually using hand-operated equipment. Grading may be required to restore the gradient of the streambed to allow fish passage.

f. Sediment Bars

Removal of fish passage barriers at certain types of sediment bars or terraces would proceed similarly to removal of debris jams (see paragraph 4(e) above).

g. Site Restoration

Following completion of the construction elements, the work areas would be restored and enhanced. Temporary access roads and platforms would be removed [see Conservation Measure m(iii)]. Temporary access roads would be removed with trackhoes, bulldozers, and dump trucks. Using helicopters, bulldozers, or trackhoes, large woody debris may be placed (and anchored, if necessary) to enhance instream habitat [see Conservation Measures (g) and (i)]. Riparian areas would be planted [see

Conservation Measures (g), (s)(iv), and (v)] using hand labor crews and hydroseeding equipment.

h. Post-Construction Monitoring

The site shall be monitored after construction to assure that the installation (or removal) is functioning as planned and to determine if any maintenance is needed to maintain fish passage [see Conservation Measures (u) and (w)]. Monitoring will consist of site visits during a variety of flow conditions as well as evaluation of the physical parameters of the installation (i.e. outlet and inlet drop of new culvert, culvert damage and stability, debris accumulation).

Action Area

The action area includes all areas that could potentially be affected by the covered activities, considering implementation of the required conservation measures described below. The action area will vary based on each species under consideration. The programmatic biological evaluation for removal of fish passage barriers is intended to cover the specified activities throughout the state of Washington.

For terrestrial wildlife species, the limits of the action area for individual projects would include all areas within 1 mile of the work area. Beyond 1 mile, noise, dust, air quality, and habitat impacts would not affect listed wildlife species.

For plants, the action area for individual projects would be limited to approximately 100 yards of the limits of the work area. Beyond 100 yards, impacts from project activities would not affect listed plant species.

For fish and aquatic wildlife species, the action area for individual projects would be no more than 2 miles downstream (or within 0.5 miles for tidal situations) and no more than 0.5 miles upstream of the project area boundary. Beyond these limits, project impacts on water quality, noise, flooding characteristics, and habitat would not affect listed fish and aquatic wildlife species.

Conservation Measures

Activity Specific

a. In addition to standard permit application requirements[103], project proponents must submit the following supplemental documentation:

   i. Locations and footprints of equipment ingress/egress points [may be shown on project plans, see Conservation Measure m (iv)] and

   ii. Description of the project bypass method [including drawings, see Conservation Measure (n)].

   Other supplemental documentation may be required by Conservation Measures (c) [discussion of potential alternatives], (k) [modification of timing windows], (o)(ii)(*c*) [electroshocking], and (w) [a planting plan for projects that remove or degrade riparian vegetation].

b. Projects will be designed to meet either WDFW's fish passage criteria for salmon and trout (WDFW 1999) or other criteria that are specified by the Services.

   i. Fish passage barriers may not be removed in those streams where bull trout are isolated above a barrier from non-native species, such as brown or brook trout.

c. Projects designed to remove fish passage barriers will avoid and minimize long- and short-term impacts to stream and riparian habitat. For stream crossings, complete removal of the culvert or blockage will be implemented wherever feasible. For replacement or retrofit culverts or tide gates, removal and abandonment of the crossing/tide gate, a full-spanning bridge, or a full-spanning arch or bottomless culvert are presumed to be practicable alternatives unless clearly demonstrated otherwise. In addition, bridges and full-spanning arch or bottomless culverts are

[103]Permit application requirements include the name, address, and telephone number of the project proponent; the location of the proposed work; and a brief description of the proposed project and its purpose. When completed, the Joint Aquatic Resources Permit Application (JARPA) form contains the standard information. For this programmatic consultation, the applicant also must complete and submit the Specific Project Information Form (SPIF) for ESA Programmatic Consultation.

presumed to have less adverse impact on the aquatic environment, unless clearly demonstrated otherwise.

Accordingly, for replacement or retrofit culverts or tide gates (see exception below), applicant must provide a written analysis of the practicability of crossing removal and abandonment, bridge, and full-spanning arch or bottomless culvert that will be based on the following factors:

i. The fish and wildlife habitat functions that would be lost and/or restored by the proposed project and the potential alternatives;

ii. The predicted cost associated with construction, maintenance, and repair (over the forecast life of the project) for the proposed project and the potential alternatives;

iii. For the proposed project and the potential alternatives, the risk or probability of future crossing failure or loss of fish passage due to reasonably foreseeable trends in watershed development and extreme flow events; and

iv. The potential of the proposed project and the potential alternatives to contribute to maintenance or achievement of properly functioning habitat conditions for salmonids in the watershed.

EXCEPTION: The prescribed alternatives analysis is not required for bridges, arch culverts, or bottomless culverts with footings located at least 1.2-times the average channel bed width. The channel bed width shall be determined from measurements of the stream corridor up- and downstream of the crossing location but outside of the influence of the existing crossing structure. In cases where the channel bed width is poorly defined or indeterminate, the footings must be located at least 1.2-times the width corresponding to the 2-year recurrence interval flood (WDFW, 1999).

d. Large woody debris, boulders, and spawning gravel required for habitat restoration may be salvaged from construction or access areas but otherwise will not be taken

from streams, wetlands or other sensitive areas. With the exception of salvage from construction or access areas, large woody debris shall not be obtained from standing or fallen trees within 250 feet landward of the edge of any stream or wetland.

e. Materials used for habitat restoration activities will be of natural origin (e.g. coir wraps, coir logs, natural anchors, etc.) if they are to be retained in the landscape following completion of construction. Culverts, bridges, their footings, and materials necessary for their structural support may be man-made.

f. Excavated material will either be salvaged or disposed of and stabilized properly in upland areas where the potential for future environmental problems is minimized.

g. Public safety issues such as downstream bridge or culvert crossings that could be reasonably assumed to be endangered by stream-borne logs may necessitate anchoring of placed LWD. Where unavoidable, anchoring will be accomplished either by placing large boulders on top of the log, burying one end of the log in the bank (sometimes in conjunction with boulder placement), or cabling the log to an anchor (such as a boulder, a buried ecology block, screw anchor, or driven anchor bar). Anchoring requiring excavation (e.g. ecology block burial) within the ordinary high water mark of the stream or in vegetated areas shall occur before streamflow is re-introduced into the work area and during the approved work window [see Conservation Measure (k)].

h. All material used to restore the streambed inside a replacement culvert or under a bridge shall have enough fine materials to seal the bed (via natural processes or the particle size distribution of the material used to restore the streambed). The maximum particle size of the replacement streambed is determined by the hydraulic analysis and the fish passage flow at the proposed structure. The recommended particle size distribution of replacement streambeds is described in the following table (WDFW, 1999):

Maximum Particle Size (D_{100})	Particle Size Distribution			
9 in.		40%<2 in.	30% 2-5 in.	30% 5-9 in.
12 in.		40%<3 in.	30% 3-7 in.	30% 7-12 in.
18 in.	15%<1 in.	25% 1-5 in.	30% 5-11 in.	30% 11-18 in.
24 in.	10%<1 in.	30% 1-6 in.	30% 6-14 in.	30% 14-24 in.
30 in.	10%<1 in.	30% 1-8 in.	30% 8-18 in.	30% 18-30 in.

i. Vegetative or integrated streambank protection methods (e.g. herbaceous ground cover, rooted stock, live stakes and slips, fascines, brush mattresses, brush layers, joint plantings, vegetated geogrids, live cribwalls, tree revetments) will be installed along with the installation of large woody debris and boulders to provide fish habitat and hydraulic diversity in the project reach.

j. Bank stabilization using rock, concrete, bulkheads, wingwalls, or similar structures shall be limited to the existing road fill prism.

EXCEPTION: Streambank stabilization using rock may be used to key streambed controls into the streambank. No more than 3 cubic yards of rock may be used for each streambed control.

General Construction

k. **Timing:** Construction shall occur only during the approved work window. (See Appendix C for approved work windows).

EXCEPTION: Timing windows may be adjusted based on project-specific criteria approved by the Corps and Services via the tiered consultation procedures. For example, placement of large woody debris or boulders into channels may be more effective and safer during winter when leaf cover is less and overhead visibility is greater.

l. All necessary local, State, and Federal authorizations will be secured prior to project implementation and copies kept at the project site; these include but are not limited

to: State Hydraulic Permit Approval, local clearing and grading permit, U.S Army Corps of Engineers permits and associated ESA documentation, State Environmental Protection Act checklist, and Shorelines permits. Construction activities shall adhere to the strictest conditions set-forth in these permits, with particular deference to requirements of the Endangered Species Act.

m. **Heavy Equipment Standards and Requirements:** Wherever heavy equipment or power equipment is used, the following measures should be taken to minimize effects on the landscape, associated habitat and species in the area.

   i. The contractor will be required to have a Spill Prevention Control and Containment Plan (SPCCP). The SPCCP will take measures to reduce the impacts from potential spills (fuel, hydraulic fluid, etc). These measures will be in place prior to the start of any construction action.

   ii. Equipment staging or refueling areas must be located at least 150 feet from the edge of wetlands and streams, in areas where environmental effects from accidental spills or leakage will be minimized. Equipment will be inspected daily for leaks or accumulations of oil or grease and any identified problems will be fixed before entering areas that drain directly (without any stormwater treatment) to streams or wetlands.

   iii. Existing paths and roadways will be used for access to project sites, where feasible. If existing paths and roadways cannot be used (i.e. due to long distance from the work area) or do not exist, no more than 2 temporary roads to allow mechanized equipment to access the project area may be installed. Upon project completion, temporary roads will be graded and all resulting unvegetated, compacted road surfaces will be tilled and planted to promote vegetation re-establishment.

   iv. Equipment ingress/egress points shall be as indicated on the project plans. Access points shall be designed to minimize impacts and, in most cases, equipment should be stationed on top of the stream bank; rather than in the stream, during excavation or placement of materials in the stream.

v. Stream crossings with heavy equipment shall be avoided or minimized to the maximum practicable extent. If stream crossings are unavoidable, they shall be located as indicated on the project plans and positioned to avoid potential salmonid spawning areas and to minimize compaction of the streambed. Where possible, the equipment operator will use temporary pads such as boulders, logs or pads to cross the stream at right angles to the main channel.

n. **Bypass Requirements:** The work area shall be isolated from stream flow by temporarily diverting the flow from the work area or by bypassing the work area altogether. Flow will be diverted using structures such as cofferdams or aqua barriers. If the stream contains fish, fish must be removed prior to the start of construction [see Conservation Measure (o)] and actions must be taken to minimize effects on fish adjacent to the work area. The temporary bypass must be sized large enough to accommodate the predicted peak flow rate during construction. Dissipation of flow at the outfall of the bypass system (e.g. splash protection, sediment traps) is required to diffuse the erosive energy of the flow. Water quality below the bypass outfall shall be in compliance with established standards [Conservation Measure s(viii)] to minimize effects on habitat and associated fish downstream of the bypass. Water removed from the de-watered work area shall be pumped to upland areas and treated as necessary to ensure that it is in compliance with established standards [Conservation Measure s(viii)] upon re-entering any wetland, stream, or any other waterbody. To ensure that the work area is never exposed to flowing water (i.e. due to unexpected rain during the work period), bypass requirements apply to seasonally dry streams as well as streams with perennial flow.

The following are general approaches available (in no particular order) for temporary stream bypass systems:

- Leave the stream in its existing channel until the new culvert or channel are completed, then move the stream into the new channel and abandon the old. To allow the new channel and associated vegetation to stabilize and mature, flow shall not be introduced into new channel alignments for at least one year after the completion of construction. Channel relocation shall be limited to that necessary to restore fish passage at the existing passage barrier.

- Use piping to convey stream flow around the project area. In some instances, an existing culvert can be used as the bypass, with construction proceeding next to or around the old culvert.

- Construct a temporary channel to carry stream flow during construction.

- Pump stream water to downstream of the fish exclusion reach. Bypass pumping shall occur only in the stream reach isolated by upstream and downstream block nets, but not from within the work area.

- Combine approaches to create a practical bypass system; for example, pump the stream flow downstream during work hours and pipe it through the work area during off-hours.

The project bypass method shall be specified in the project description and reviewed by the Corps and the Services as specified in the tiered consultation procedures.

o. **Fish Removal Protocols and Standards:** Fish shall be removed from the work area according to the following methods (developed from RRMTWG, 2000; see exception below):

i. Isolate the Area: Install block nets at up and downstream locations to isolate the entire affected stream reach. This is done to prevent fish and other aquatic wildlife from moving into the work area. Block net mesh size, length, type of material, and depth will vary based on site conditions. Generally, block net mesh size is the same as the seine material (9.5 millimeters stretched). During fish removal activities, the block nets shall be then left in place and checked at least once daily to make sure the nets are functioning properly. Block nets require leaf and debris removal to ensure proper function. An individual must be designated to monitor and maintain the nets. Block nets are installed securely along both banks and in channel to prevent failure during unforeseen rain events or debris accumulation. Some locations may require additional block net support such as galvanized hardware cloth or additional stakes or metal fence posts. The block nets shall be left in place throughout the fish removal activity and not

removed until flow has been bypassed around the work area [see Conservation Measure (n)].

ii. Fish Removal from the Isolated Area: The following methods provide alternatives for removal of fish from the area between the block nets. The methods are given in order of preference. Drag netting or seining through the isolated stream reach shall be the default technique. The remaining methods shall be used only if seining is not possible. Electroshocking requires approval based on a project-specific plan approved by the Corps and Services via the tiered consultation procedures (see exception below).

a. Lengths of 9.5 mm stretched nylon mesh minnow seines are used throughout the isolated stream reach. The seine is approximately three feet wide and of various lengths with approximately fifteen feet of rope attached to either end. Sets of the seine are conducted with one person on shore and one to two people working the other end of the net through the isolated stream reach area. Once the net is out and the lead line dropped to the bottom, the other end of the 15-foot line is brought to shore and both ends of the net are pulled in quickly in tandem.

b. Collecting aquatic life by hand or with dip nets as the site is slowly dewatered.

c. Electrofishing in stream channels shall be done only where other means of fish exclusion are not feasible and where specifically approved by the Corps and Services as part of a project-specific plan (see exception below). Protocol for electrofishing is summarized below:

1) No electrofishing in anadromous waters from October 15th to May 15. No electrofishing in resident waters from November 1st to May 15th. Electrofishing shall not contact spawning adult salmonids or active redds.

2) Equipment must be in good working condition and operators shall go through the manufacturer's preseason checks, adhere to all provisions, and record major maintenance work in a logbook.

3) Measure conductivity and set voltage as follows:

Conductivity (μmhos/cm)	**Voltage**
Less than 100	900 to 1100
100-300	500 to 800
Greater than 300	to 400

4) Only Direct Current (DC) or Pulsed Direct Current (PDC) shall be used.

5) Each session shall begin with pulse width and rate set to the minimum needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured. Start with pulse width of 500 μseconds and do not exceed 5 milliseconds. Pulse rate should start at 30 Hz and work carefully upwards. In general, exceeding 40 Hertz (Hz) will injure more fish.

6) Do not allow fish to come in contact with the anode. The zone of potential fish injury is 0.5m from the anode. Care shall be taken in shallow waters, undercut banks, near structures such as wood, or where fish can be concentrated in high numbers because in such areas the fish are more likely to come into close contact with the anode.

7) Electrofishing shall be performed in a manner that minimizes harm to fish. The stream segment shall be worked systematically, moving the anode continuously in a herringbone pattern through the water. Do not electrofish one area for an extended period of time. Remove fish from the electrical field immediately; do not hold fish in net while continuing to net additional fish.

8) Carefully observe the condition of the excluded fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit may need adjusting. ESA specimens will be released immediately upstream of the block nets in an area that provides refuge. Each fish shall be completely revived before releasing (see iii below).

9) A healthy environment for the stressed fish must be provided, with no overcrowding in the buckets, and the holding time minimized. Large fish shall be kept separated from smaller prey-sized fish to avoid predation during containment. Water to water transfers, the use of shaded, dark containers and supplemental oxygen shall be considered in designing fish handling operations.

d. Trapping using minnow traps. Traps will be left in place between each pass.

e. When removing fish out of the isolated stream reach, all attempts to remove fish out of the existing stream crossing structure shall be made. Connecting rod snakes may be used to help get the fish to move out of the structure. The connecting rod snake is inserted and wiggled through the pipe or other structure to get the fish to move out so they can be captured and removed out of the stream reach. The connecting rod snake is made of wood sections with metal couplers with sections approximately three feet in length. As the snake is wiggled slowly through the pipe, noise and turbulence will help to get the fish to move out without harming them.

f. Pumps used to temporarily bypass water around work sites shall be fitted with mesh screens to prevent aquatic life from entering the trash pump hose. The screens shall be installed as a precautionary measure to prevent any fish and other wildlife that may have been missed in the fish exclusion process. The screens will also prevent fish and other wildlife from entering the trash pump if a block net should fail. Screens will be placed approximately 2-4 feet from the inlet of the trash pump hose to avoid the suction of the trash pump.

iii. Fish Release: For the period between capture and release, all captured aquatic life shall be immediately put in dark colored five gallon buckets filled with clean stream water. Frequent monitoring of bucket temperature and well being of the specimens will be done to assure that all specimens will be released unharmed. Any injuries or mortalities to ESA listed or proposed species will be documented and reported to the Corps, NMFS, and USFWS. Any fish killed that are identified or suspected as listed or proposed species shall be provided to NMFS or the

USFWS, depending on which agency has jurisdiction over that species. Captured aquatic life will be released upstream of the isolated stream reach in a pool or area which provides some cover and flow refuge.

EXCEPTION: The fish removal protocols and standards identified in this conservation measure may be modified by a project-specific plan developed by the project proponent and approved by the Corps and Services via the tiered consultation procedures. Electroshocking may be implemented only if approved as part of a project-specific plan.

p. Hand labor crews will complete all portions of projects that do not require major excavation or grading (requiring movement of greater than 3 cubic yards of material from one location) or movement of large objects (such as woody debris larger than1 foot, diameter breast height).

q. Washing of replacement substrate shall not occur where the wash water can enter any stream, watercourse, or wetland.

r. No uncured concrete shall come into contact with the waterbody. Washout of concrete trucks and equipment is prohibited within 250 feet landward of the edge of any stream, lake or wetland, unless dedicated washout facilities designed to treat the wash water are used. Wash water shall not enter into any waterbody prior to meeting Washington State Water Quality Standards (WAC 173-210A).

Erosion & Sediment Control

s. **Erosion and Sediment Control Protocols and Standards**: Erosion and sediment control (ESC) measures must be designed and implemented before there is any opportunity for storm runoff to create erosion. Project designs shall emphasize erosion control rather than sediment control. The following are summaries of the principles and specific measures to be used during any construction projects where erosion and sediment problems could arise:

i. If rain falls during construction, and ESC measures are not adequate to maintain water quality downstream of the site (per WAC 173-201A or current standard), then all construction activities, except for those necessary to stabilize the site, shall stop until the storm ceases and downstream water quality has returned to pre-storm conditions. The ESC measures must be re-designed to address the deficiencies, approved by the Corps, and installed prior to re-starting construction.

ii. Install construction entrances that have been designed and stabilized to reduce the amount of sediment transported off-site by construction vehicles and to reduce the area disturbed by vehicle traffic.

iii. Prior to any clearing or grading, minimize the extent of site disturbance by delineating construction limits with flagging and/or fencing.

iv. To minimize the duration of area exposed, projects will be completed as quickly as possible without compromising the quality of work and disturbed areas shall be stabilized within 3 days of the end of construction.

- Temporary and permanent cover measures shall be provided to protect disturbed areas (e.g. erosion control and blankets, plastic covering, mulching, seeding or sodding). Temporary cover shall be installed if any cleared or graded area is to remain un-worked for more than seven days from June 1-Sept 30; and for more than two days from Oct 1 - May 31. Temporary cover shall be completed within 12 hours of cessation of work in areas that will remain un-worked for the specified time periods. As long as the covering remains in place, planting or seeding is not required in covered areas until conditions are appropriate for growth.

- All disturbed areas will be re-planted with native vegetation within 3 days of the end of construction, unless covered or otherwise stabilized with appropriate erosion and sediment control measures. Planting shall be completed no later than March 1 of the year following construction [see Conservation Measure (w)].

v. Sandbags or an equivalent barrier shall be constructed between the project area and the surface water in order to isolate the construction area from high water that might result due to precipitation (see Conservation Measure (n) for temporary bypass requirements).

vi. Reduce the amount of sediment transported beyond the disturbed areas of the construction site by installing and/or maintaining appropriate perimeter protection measures (vegetated strips, brush barriers, silt fences, erosion control curtains) prior to the start of construction.

vii. Preventative measures to minimize wind transport of soil (i.e. water spraying) shall be taken when sediment is likely to be deposited in water. The amount of water sprayed shall be the minimum necessary to prevent airborne dust and sediment.

viii. The site will be thoroughly monitored for turbidity and all ESC measures will be maintained until construction is complete and site conditions stabilize. The goal of monitoring activities will be to ensure that water quality is in compliance with the Washington State Water Quality Standards for turbidity (WAC 173-201A-030 or current standard). A minimum of two monitoring stations will be established – one above the project site to establish the background level and one below the site to measure the project's effect on turbidity – the location and required compliance level of which will be determined by state standards (WAC 173-201A or current standard). During construction, turbidity will be measured using a hand-held turbidity meter at least 3 times per workday. If turbidity exceeds specified state standards and non-compliance zones, work will be stopped and actions taken to reduce and/or eliminate the source of turbid discharge shall be taken until turbidity levels are in compliance. Additional monitoring stations may be established in situations where the Corps' and Services' water quality compliance standards for meeting ESA Section 7 compliance differs from that of the state.

t. Barriers shall be installed to prevent surface runoff from entering the construction area. To remove particulate matter, water pumped from the construction area shall be treated prior to reintroduction to a storm drainage system, stream, wetland, or other waterbody. Water discharged from the site shall not cause erosion at or near the outfall location and shall meet state water quality standards (WAC 173-201A or current standard).

Post-Construction Requirements

u. Upon project completion, all waste from project activities will be removed from the project site.

v. Site inspections will be performed by a qualified biologist after project completion to assure that the project is progressing as planned and that there are no unintended consequences to fish, wildlife and plant species and their habitat. Detailed inspections will be made on all construction projects immediately following the onset of the rainy season – with inspections during or immediately after the first freshet following construction. Any necessary corrective measures must be evaluated with respect to their urgency and potential effects on listed species, and must be agreed upon by the Corps before implementation. Corrective measures requiring in-stream work or other work likely to cause erosion will be implemented during the following work window.

w. **Planting Requirements:** No later than March 1 of the year following construction, native vegetation shall be re-planted in all areas where vegetation was removed or degraded during construction. Along with other project documentation, the project proponent shall submit a planting plan that includes the location, species and density of the proposed plantings; a planting schedule; performance standards; monitoring schedule; and contingency measures. [Details of the monitoring requirements can be found in the "Individual Project Monitoring" section of this programmatic biological evaluation.]

x. **Monitoring for Fish Passage Conditions:** Culvert replacements and modifications will be monitored by qualified personnel for passage of the target fish species and life history stage during summer, high (greater than or equal to the 5-year flow event) and bankfull discharge or for 6 years, whichever is sooner. Monitoring shall document the hydraulic conditions (depth; velocity; elevation drop at inlet, outlet, and within the culvert/under the bridge) around and through the structure at each of the stated flow thresholds. In the event that the project does not meet the velocity, flow, depth, and elevation drop standards to allow passage of the target fish species and

life history stage, the permittee shall implement corrective actions necessary to allow fish passage of the target species at the project site. The corrective actions must be approved by the Corps prior to implementation and the Corps may need to reinitiate consultation if proposed measures are not covered by an existing Section 7 consultation.

y. Sandbags shall be filled with washed material, 3.00 mm or greater in diameter, or shall be composed of impermeable material and sufficiently sealed so as to prevent the delivery of fine sediments (< 3.0 mm) into the affected watercourse. All sand bags shall be removed from the affected waterway and disposed or stored above the ordinary high water mark of the affected stream. The sandbags shall be removed at the earliest possible opportunity once ambient stream flow conditions recover to the obviation of the fish passage or fish survival emergency. In each case, sandbags will be removed prior to 1 November. In the event that the installation of the sand bags has the potential to strand fish near channel margins, fish capture and rescue procedures shall be conducted in accordance with conservation measure (o) to the extent that the provisions therein apply.

Anticipated Impacts

Removal of fish passage barriers will result in impacts to the aquatic and adjacent riparian environment. The intent of the activities is to restore the stream corridor to more natural function, but short-term adverse impacts due to construction will occur. The direct, interrelated, interdependent, and indirect effects consider the impacts in light of the required conservation measures.

Direct Effects

The following potential effects are direct or immediate effects of the different types of covered activities described above:

- Mortality, injury, or sub-lethal adverse effects to fish species.
- Short-term stress to fish due to removal or relocation within the work area.
- Short-term decrease in habitat complexity and function due to removal of vegetation and or other habitat structures.

- Short-term loss of potential habitat available to fish, wildlife, and plant species in the project vicinity (including loss of instream habitat during construction).
- Complete blockage of fish passage during construction.
- Short-term decrease in localized air quality due to airborne dust and exhaust from heavy equipment.
- Short term delivery of excess sediment to, and decreased water quality in, downstream habitat during construction and upon reintroduction of streamflow to work area.
- Short-term displacement of fish and wildlife due to turbidity, human/machinery presence, activity, noise, and water quality.
- Short-term risk of petroleum spills in the construction area.
- Loss of riparian vegetation in the construction area.

Interrelated Effects

The following potential effects may occur as a result of the activities that are part of the covered activities and that depend on the covered activities for their justification:

- Potential change in duration, extent, frequency, and severity of flooding up and downstream of project area.
- Water quality improvement (improved stormwater treatment facilities may be components of road projects that remove fish passage barriers).

Interdependent Effects

The following potential effects may occur as a result of activities that have no independent utility apart from the covered activities:

- Decreased frequency and severity of habitat disturbance due to emergency and routine maintenance of the crossing facility.

Indirect Effects

The following effects may be caused by or may result from the covered activities but are later in time:

- Enhanced access to upstream habitat for fish and aquatic wildlife.
- Better connectivity between upstream and downstream habitat.

- Potential for increased genetic diversity of a given species.
- Potential for increased diversity of species in upstream areas.
- A greater proportion of channel bedload and woody debris can remain in system and pass through the crossing facility.
- Potential interbreeding between bull trout and brook trout populations that were previously isolated from each other by the fish passage barrier.
- Increase in amount and diversity of available habitat for anadromous and migratory forms of fish and aquatic wildlife.
- Increased nutrient loading of areas upstream of the fish passage barrier from decay of adult salmonids following spawning.
- Rehabilitation of natural bedload size and quantity.
- Rehabilitation of instream physical processes that were interrupted by the barrier.
- Potential for decreased scour at the culvert outlet.
- Potential for headcutting at the culvert inlet.
- For culverts replacements, potential for future failure of the culvert due to extreme flow events or inadequate design/construction (i.e. improper headwall design could lead to excess hydrostatic pressure on fill and subsequent culvert failure during a large flood event).
- Change in amount of instream pool and riffle habitat from placement of weirs or streambed controls.
- Enhanced riparian vegetation in the project vicinity.

Determinations of Effect to Threatened and Endangered Species

Removal of fish passage barriers covered by this document may affect certain threatened and endangered species, species proposed for listing as threatened or endangered, and designated or proposed critical habitat for those species. All proposed and listed threatened and endangered species (and their critical habitat, as appropriate) that may occur in the state of Washington are addressed in Table VI-3.

Table VI-3. Determinations of Effects on Listed and Proposed Threatened and Endangered Species from the Covered Activities Intended to Remove Fish Passage Barriers

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
BIRDS				
Bald eagle (*Haliaeetus leucocephalus*)	Threatened	N	Not Likely to Adversely Affect	The work will be prohibited during sensitive nesting or wintering periods (see App. F), but short-term removal or degradation of riparian habitat, temporary displacement during construction, and risk of petroleum spills have the potential to adversely affect bald eagles. Direct mortality or sub-lethal effects are unlikely.
Brown pelican (*Pelecanus occidentalis*)	Endangered	N	Not Likely to Adversely Affect	In Washington, brown pelicans inhabit only coastal marine waters in areas where activities to remove fish passage barriers are extremely unlikely.
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Y	Not Likely to Adversely Affect (for species and critical habitat)	Activities may affect nesting areas. Work will be prohibited during of sensitive nesting periods (see App. F), but short-term removal or degradation of riparian habitat and temporary displacement during construction have the potential to adversely affect marbled murrelets. Direct mortality or sub-lethal effects are unlikely.
Northern Spotted owl (*Strix occidentalis*)	Threatened	Y	Not Likely to Adversely Affect (for species and critical habitat)	The work will be prohibited during sensitive nesting periods (see App. F), but short-term removal or degradation of riparian habitat, temporary displacement during construction, and risk of petroleum spills have the potential to adversely affect spotted owls. Direct mortality or sub-lethal effects are unlikely.
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	N	No Effect	In Washington, short-tailed albatross inhabit only coastal and off-shore marine waters in areas where activities to remove fish passage barriers will not occur.
Western snowy plover (*Charadrius alexandrinus*)	Threatened	Y	No Effect (for species & critical habitat)	Work will be prohibitated in sensitive nesting areas (App. F). Southwest Washington is furthest known northern area for snowy plovers. Plovers inhabit only ocean beach areas in Pacific and Grays Harbor counties, areas where activities to remove fish passage barriers will not occur.
MAMMALS				
Canada lynx (*Lynx canadensis*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive habitat areas (App. F). Activities to remove fish passage barriers in more remote areas of the Selkirk Mountains or the Cascade Range may temporarily displace lynx or result in short-term degradation of riparian areas in lynx habitat. Direct mortality or sub-lethal effects are unlikely.

Table VI-3

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Columbia white-tailed deer (*Odocoileus virginianus leucurus*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive habitat areas (App. F). Activities to remove fish passage barriers along the lower Columbia River from River Mile (RM) 50 to RM 52) may temporarily displace Columbia white-tailed deer or result in short-term degradation of riparian areas in deer habitat. Removal of tide gates that results in potential for increased flooding duration or severity within the range of the deer may result in direct mortality, but the likelihood of direct mortality or sub-lethal effects is low.
Gray wolf (*Canis lupis*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive habitat areas (App. F). Activities to remove fish passage barriers in more remote areas of the Selkirk Mountains or the Cascade Range may temporarily displace wolf or result in short-term degradation of riparian areas in wolf habitat. Direct mortality or sub-lethal effects are unlikely.
Grizzly bear (*Ursus arctos horribilis*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibitated in sensitive habitat areas (App. F). Activities to remove fish passage barriers in more remote areas of the Selkirk Mountains or the Cascade Range may temporarily displace grizzly bears or result in short-term degradation of riparian areas in grizzly habitat. Direct mortality or sub-lethal effects are unlikely.
Pygmy Rabbit (*Barchylagus idahoensis)*	Endangered	N	No Effect	Pygmy rabbits occur in the shrub steppe habitat of Douglas County, Washington. Activities to remove fish passage barriers would not occur in areas in or adjacent to habitats that support the pygmy rabbit.
Woodland caribou (*Rangifer tarandus caribou*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive habitat areas (App. F). Activities to remove fish passage barriers in the Selkirk Mountains may temporarily displace caribou or result in short-term degradation of riparian areas in caribou habitat. Direct mortality or sub-lethal effects are unlikely.
MARINE MAMMALS				
Blue Whale (*Balaenoptera musculus*)	Endangered	N	No Effect	The blue whale occurs in marine areas where activities to remove barriers to fish passage will not occur.
Fin Whale (*Balaenoptera physalus*)	Endangered	N	No Effect	The fin whale occurs in marine areas where activities to remove barriers to fish passage will not occur.
Humpback Whale (*Megaptera novaeangliae*)	Endangered	N	No Effect	The humpback whale occurs in marine areas where activities to remove barriers to fish passage will not occur.
Sei Whale (*Balaenoptera borealis*)	Endangered	N	No Effect	The sei whale occurs in marine areas where activities to remove barriers to fish passage will not occur.
Sperm Whale (*Physeter macrocephalus*)	Endangered	N	No Effect	The sperm whale occurs in marine areas where activities to remove barriers to fish passage will not occur.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Steller sea lion (*Eumetopias jubatus*)	Threatened	Y	Not Likely to Adversely Affect (for species and critical habitat)	In Washington, Steller sea lions inhabit pelagic areas of marine waters and occasionally move up the lower Columbia River to feed during the fall. Due to the pelagic nature of sea lions and the relatively localized effects of work adjacent to larger river systems where sea lions may occur, activities to remove fish passage barriers adjacent to the Columbia River have an insignificant and discountable chance to displace sea lions during construction. Besides construction activities, impacts from removal of fish passage barriers will not effect sea lions.
INSECTS				
Oregon silverspot butterfly (*Speyeria zerene hippolyta*)	Threatened	Y	Not Likely to Adversely Affect (for species and critical habitat)	Work will be prohibited in sensitive habitat areas (App. F). In Washington, Oregon silverspot butterflies may be extirpated but areas suitable for re-colonization or re-introduction occur in southwest Washington. Activities to remove fish passage barriers typically occur in areas that are not suitable habitat for Oregon silverspot butterflies (which inhabit coastal salt spray marshes and open meadows). There is an insignificant and discountable chance that activities to remove fish passage barriers may disturb butterfly habitat.
PLANTS				(Plant habitat information obtained from WNHP & BLM, 1999)
Bradshaw's desert parsley (*Lomatium bradshawii*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Populations of desert parsley have been identified near streams in Clark County, Washington. Bradshaw's desert parsley occurs in wet meadows that may be exposed to adverse impacts from construction activities. Adverse impacts may also occur if removal of a fish passage barrier alters the hydrology of desert parsley habitat. In areas that are potentially suitable habitat, surveys to determine the presence of desert parsley can help avoid and minimize potential adverse impacts.
Golden paintbrush (*Castilleja levisecta*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Golden paintbrush occurs in small populations in uplands in the Puget Trough, San Juan County, and Clark County. Activities to remove fish passage barriers, and the associated effects, are extremely unlikely to occur in or adjacent to golden paintbrush habitat. In areas that are potentially suitable habitat, surveys to determine the presence of desert parsley can help avoid and minimize potential adverse impacts.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Kincaid's sulphur lupine (*Lupinus sulphureus* ssp. *Kincaidii*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Kincaid's sulphur lupine occurs in upland prairie habitat in southwest Washington. Activities to remove fish passage barriers, and the associated effects, are extremely unlikely to occur in or adjacent to habitat for Kincaid's sulphur lupine. In areas that are potentially suitable habitat, surveys to determine the presence of Kincaid's sulphur lupine can help avoid and minimize potential adverse impacts.
Marsh sandwort (*Arenaria paludicola*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Marsh sandwort may be extirpated in Washington. Marsh sandwort historically occurred in freshwater wetlands of a type that may be exposed to adverse impacts from construction activities. Adverse impacts may also occur if removal of a fish passage barrier alters the hydrology of marsh sandwort habitat. In areas that are potentially suitable habitat, surveys to determine the presence of marsh sandwort can help avoid and minimize potential adverse impacts.
Nelson's checker-mallow (*Sidalcea nelsoniana*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Nelson's checker-mallow occurs in meadows and along streams in southwest Washington and the Olympic peninsula, areas that may be exposed to adverse impacts from construction activities. Adverse impacts may also occur if removal of a fish passage barrier alters the hydrology of Nelson's checker-mallow habitat. In areas that are potentially suitable habitat, surveys to determine the presence of Nelson's checker-mallow can help avoid and minimize potential adverse impacts.
Showy stickseed (*Hackelia venusta*)	Endangered	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Showy stickseed occurs in open mountain sites composed of loose sand or talus slopes, areas where activities to remove barriers to fish passage will not occur.
Spalding's silene (*Silene spaldingii*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Spalding's silene occurs in upland grasslands in eastern Washington. Activities to remove fish passage barriers, and the associated effects, are extremely unlikely to occur in or adjacent to habitat for Spalding's silene. In areas that are potentially suitable habitat, surveys to determine the presence of Spalding's silene can help avoid and minimize potential adverse impacts.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Water howellia (*Howellia aquatilis*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Water howellia occurs in seasonal wetlands in the Puget lowlands and the Columbia basin, primarily in small, vernal ponds, although some ponds may retain water throughout the year. Ponds will not likely be influenced or affected by activities to remove fish passage barriers. Adverse impacts to water howellia are extremely unlikely to occur. In areas that are potentially suitable habitat, surveys to determine the presence of water howellia can help avoid and minimize potential adverse impacts.
Wenatchee Mountain Checker-Mallow (*Sidalcea oregana* var. *calva*)	Endangered	Y	Not Likely to Adversely Affect (for species and critical habitat)	Work will be prohibited in sensitive areas (App. F). Wenatchee mountain checker-mallow occurs in wet meadows within a small region southeast of Leavenworth, Washington, areas that may be exposed to adverse impacts from construction activities. Adverse impacts may also occur if removal of a fish passage barrier alters the hydrology of Wenatchee mountain checker-mallow habitat. In areas that are potentially suitable habitat, surveys to determine the presence of Wenatchee mountain checker-mallow can help avoid and minimize potential adverse impacts.
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	N	Not Likely to Adversely Affect	Work will be prohibited in sensitive areas (App. F). Ute ladies'-tresses can occur in wet meadows associated with meandering wetland complexes. Adverse impacts to Ute ladies'-tresses may occur from construction activities or alteration of hydrology caused by removal of fish passage barriers. In areas that are potentially suitable habitat, surveys to determine the presence of Utes ladies'-tresses can help avoid and minimize potential adverse impacts.
REPTILES/AMPHIBIANS				
Green Sea Turtle (*Chelonia mydas*)	Threatened	N	No Effect	The green sea turtle occurs in marine areas where activities to remove barriers to fish passage will not occur.
Leatherback Sea Turtle (*Dermochelys coriacea*)	Endangered	N	No Effect	The leatherback sea turtle occurs in marine areas where activities to remove barriers to fish passage will not occur.
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened	N	No Effect	The loggerhead sea turtle occurs in marine areas where activities to remove barriers to fish passage will not occur.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
FISH				
Snake River sockeye (*Oncorhynchus nerka*)	Endangered	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Snake River spring/summer chinook (*Oncorhynchus tshawytscha*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Snake River fall chinook (*Oncorhynchus tshawytscha*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Snake River steelhead (Oncorhynchus mykiss)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Columbia River chum (*Oncorhynchus keta*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Columbia River bull trout (*Salvelinus confluentus*)	Threatened	N	Likely to Adversely Affect	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Due to the difficulty with capturing and removing juveniles from the work area (they tend to take refuge in the substrate, making them harder to net or electroshock), bull trout are very susceptible to be killed during construction activities. Mortality of and disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.

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SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Lower Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Lower Columbia River chinook (*Oncorhynchus tshawytscha*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.

Table VI-3

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Upper Columbia River steelhead (*Oncorhynchus mykiss*)	Endangered	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Upper Columbia River spring chinook (*Oncorhynchus tshawytscha*)	Endangered	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Upper Willamette River Chinook (*Oncorhynchus tshawytscha*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Activities to remove fish passage barriers in Washington State have the potential to affect only the migratory corridor of Willamette River salmonid stocks. While adults from the Willamette River will not utilize areas subject to the covered activities, access to by juvenile fish from these stocks may be affected by the work. Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing rearing habitat.

Table VI-3

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Upper Willamette River Steelhead (*Oncorhynchus mykiss*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Activities to remove fish passage barriers in Washington State have the potential to affect only the migratory corridor of Willamette River salmonid stocks. While adults from the Willamette River will not utilize areas subject to the covered activities, access to by juvenile fish from these stocks may be affected by the work. Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing rearing habitat.
SW Washington/Columbia River/Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)	Threatened (proposed)	N	Will Not Jeopardize (if listed, Likely to Adversely Affect)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat. Adverse effects are expected to be temporary and the covered activities will benefit Salmonids in the long-term.
Ozette Lake sockeye (*Oncorhynchus nerka*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.

Table VI-3

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Hood Canal summer chum (*Oncorhynchus keta*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Puget Sound chinook (*Oncorhynchus tshawytscha*)	Threatened	Y	Likely to Adversely Affect (for species and critical habitat)	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.
Coastal/Puget Sound bull trout (*Salvelinus confluentus*)	Threatened	N	Likely to Adversely Affect	Salmonids may be killed or injured during construction, particularly during de-watering activities. Fish that are removed from the work area may be stressed and suffer sub-lethal effects. Fish passage through the work area would be blocked during construction. Due to the difficulty with capturing and removing juveniles from the work area (they tend to take refuge in the substrate, making them harder to net or electroshock), bull trout are very susceptible to be killed during construction activities. Mortality of and disturbance to listed fish can be minimized by working during periods of low fish abundance. Riparian vegetation may be destroyed, degrading salmonid habitat. Potential for fuel spills could kill fish or degrade habitat. After construction, sediment may be carried downstream from the work area for a short period. Changes in the stream may cause channel aggradation or degradation, potentially destabilizing spawning, rearing, and holding habitat.

Table VI-3

SPECIES NAME	STATUS	CRITICAL HABITAT	DETERMINATION OF EFFECT	RATIONALE FOR EFFECT DETERMINATION
Coastal/Puget Sound dolly varden (*Salvelinus malma*)	Similarity of Appearance to Threatened Taxon (Proposed)	N	N/A	Protection under Section 7 not effective for Dolly Varden since it is proposed under "similarity of appearance" (to bull trout) provisions of the Endangered Species Act.

Essential Fish Habitat

Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires Federal agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH).

The objective of this EFH assessment is to determine whether or not the proposed action(s) "may adversely affect" designated EFH for relevant commercially, federally-managed fisheries species within the proposed action area. It also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

Location

The proposed activities may occur in various waterbodies throughout the State of Washington.

Description of Proposed Activities

Briefly, this assessment addresses the potential effects on EFH resulting from removal of fish passage barriers caused by:

- Stream crossings by roads, levees, dikes, or similar features;
- Tide gates;
- Certain types of debris jams;
- Certain types of sediment bars and flood terraces.

The activities covered by this assessment have been described in detail earlier in this chapter (see pp. V-2 through V-10).

Potential Adverse Effects of Proposed Project

EFH for ground fish (Table VI-4) and salmonids (Table VI-5) would be affected by projects intended to remove barriers to fish passage.

Table VI-4. Ground fish species with designated EFH and the life history stages that may occur near activities to remove fish passage barriers (PFMC, 1998a).

GROUND FISH SPECIES	Adults	Spawning/ Mating	Large Juvenile	Small Juvenile	Larvae	Eggs/ Paturition
Leopard Shark	X	X	N/A	X	N/A	X
Soupfin Shark	X	X	N/A	X	N/A	X
Spiny Dogfish	X		X	X	N/A	X
California Skate	X	X	N/A	X	N/A	X
Ratfish	X	X	N/A	X	N/A	
Lingcod	X	X	X	X	X	X
Cabezon	X	X	X	X	X	X
Kelp Greenling	X	X	X	X	X	X
Pacific Cod	X	X	N/A	X	X	X
Pacific Whiting (Hake)	X	X	N/A	X	X	X
Sablefish				X		
Jack Mackerel	X		N/A		X	
Black Rockfish	X			X		
Bocaccio				X	X	
Brown Rockfish	X	X	N/A	X		X
Calico Rockfish	X		N/A	X		
California Scorpionfish						X
Copper Rockfish	X		X	X		X
Kelp Rockfish				X		
Quillback Rockfish	X		X	X	X	X
English Sole	X	X	N/A	X	X	X
Pacific Sanddab			N/A	X	X	X
Rex Sole	X		N/A			
Starry Flounder	X	X	N/A	X	X	X

N/A - Not Applicable. Either the species does not have a particular life stage in its life history, or when EFH of juveniles is not identified separately for small juvenile and large juvenile stages. For many species, habitats occupied by juveniles differ substantially, depending on the size (or age) of the fish. Frequently, small juveniles are pelagic and large juveniles live on or near the bottom; these life stages are identified separately in the table when sufficient information is available to do so. When juvenile habitats do not differ so substantially or when information is insufficient to identify differences, EFH is identified only for the juvenile stage (small and large juveniles combined), and N/A is listed in the column for the large juvenile stage in the table (PFMC, 1998a).

Table VI-5. Salmonid species with designated EFH and the life history stages that may occur near activities to remove fish passage barriers.

PACIFIC SALMON	Egg	Larvae	Young Juvenile	Juvenile	Adult	Spawning
Chinook salmon	X	X	X	X	X	X
Coho salmon	X	X	X	X	X	X
Pink salmon	X	X	X	X	X	X

Projects to remove fish passage barriers occur in or along the edges of freshwater or estuarine waters. Coastal pelagic species occur in offshore marine waters within Washington State and are unlikely to occur in the vicinity of the proposed activities. We do not expect the proposed activities to adversely affect EFH for coastal pelagic species.

Salmon EFH

All life history stages of pink, coho, and chinook salmon may be affected by the proposed activities because the projects may take place in both freshwater and estuarine waterbodies. In estuaries, tide gate removal or modification, along with work on the connected culvert, is likely to be the most common work type. In freshwaters, removal of fish passage barriers may entail work under any of the covered activities. Potential effects of habitat restoration projects, which includes activities designed to remove fish passage barriers, are described in Section 3.2.5.11 of PFMC (1999) and earlier in this document. (See pp. VI-33 to VI-35, Table VI-3)

Ground Fish EFH

Work in estuaries associated with removal of fish passage barriers has the potential to affect ground fish EFH. Mud flats, high salt marsh, and salt marsh creeks provide productive shallow water habitat for epibenthic fishes and decapods (Sogard and Able, 1991). Coarse sediment tidal flats are productive benthic infauna areas (Simenstad *et al*., 1990).

Construction activities associated with removal of fish passage barriers may temporarily degrade ground fish EFH by introducing sediment or restricting access to habitat. Vegetation removal may alter food web dynamics in the vicinity of the work. De-watering and fish removal may kill or injure individual fish. There will also be a risk of petroleum spills from heavy equipment working in the project area.

Restoration of fish passage in estuarine areas will often reintroduce tidal fluctuations to areas help upstream of the former blockage, helping to restore historic estuarine habitat. Life history stages of ground fish that utilize salt marsh and intertidal areas will once again be able to access areas opened by the removal of the fish passage barrier.

EFH Conservation Measures

Conservation measures designed to protect those species that listed and proposed as threatened or endangered will also help avoid and minimize impacts of the proposed activities on salmonid and ground fish EFH. A complete list of conservation measures is described earlier in this chapter (see pp. VI-19 through VI-33).

Conclusion

As described in above, the proposed activities may result in short-term adverse impacts to a variety of salmon and ground fish EFH parameters. In the long-term, the proposed activities are expected to enhance the extent and functions of salmon and groundfish EFH. We anticipate that implementation of the referenced conservation measures will avoid, minimize or otherwise offset potential adverse effects to EFH in the proposed action area.